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THESIS

THE INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM

by

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December 1983

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The Industrial Modernization Incentives Program

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ABSTRACT

Decreases in the manufacturing productivity growth rate, rising weapon systems costs, and the decline of the defense industrial base are major interrelated problems currently facing the Department of Defense (DOD). The Industrial Modernization Incentives Program (IMIP) is a DOD capital investment incentive plan designed to help alleviate these problems. The objective of this research is to trace the historical elements of the IMIP, provide an analysis of the IMIP and the actions that have been taken to implement it, and to advance recommendations regarding the IMIP for consideration during the Program test period.

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I. THE INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM

A. RECOGNITION OF THE NEED FOR INCREASED PRODUCTIVITY

Productivity, or rather the decline in the rate of productivity increase, and its associated consequences to the nation have become a major focus of attention in the Government. The decline in productivity growth has been attributed to many factors. Considered to be the prime contributors are low rates of capital investment, the general economic condition of the nation, and the effects of international competition.

The Department of Defense (DOD), the largest purchaser of capital equipment in the Federal Government, is concerned with declining productivity because it is considered to be one of the driving forces in the rapidly rising costs of DOD acquisitions. In an attempt to halt the decline in productivity, the DOD has instituted a program that is intended to increase the rate of capital investment by defense contractors. This program, the Industrial Modernization Incentives Program (IMIP), is designed to encourage contractor capital investments to enhance productivity by offering several incentives to contractors and removing or mitigating some existing disincentives to contracting with the DOD.

B. RESEARCH METHODS

The research methodology of the paper covers a broad spectrum. In most cases, primary source documents, some of

which have yet to be officially released or published, were utilized. At other times, such as when researching the historical aspects of the IMIP, secondary source documents were relied on. Data were collected directly in personal and telephone interviews with IMIP representatives of the Air Force, Army, Navy, Defense Logistics Agency (DLA), and Office of the Secretary of Defense (OSD). Also, a meeting of the tri-service team assigned to implement the IMIP was attended. Technical assistance in the areas of economic theory and cost accounting was obtained from the Logistics Management Institute (LMI) and the staff of the Naval Postgraduate School (NPS).

C. KEY AREAS OF THE PAPER

Chapter II is a detailed review of the measures taken by the DOD authorizing the IMIP and how the goals of this authorization have been embodied in a more detailed instruction and guide. Chapter III provides the status of the IMIP implementation by addressing, among other areas, the topics of IMIP Guidance, IMIP Funding, and new IMIP partnerships. Chapter IV is an historical presentation tracing chronological development from three perspectives: the decline in productivity growth; the rise in weapon systems costs; and the decline in the Defense Industrial Base (DIB). Each perspective is clarified by presenting historical data and discussion on the significance of that perspective to the development of the IMIP. Chapter V is an analysis of the current goal

attainment status of the IMIP, its benefits to the DOD and the contractors, and some potential disadvantages. Recommendations based upon the analysis are presented at the end of Chapter V.

II. FORMAL DESCRIPTION OF THE INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM

A. INTRODUCTION

The Industrial Modernization Incentives Program (IMIP) is sponsored by the Office of the Secretary of Defense (OSD) as a tri-service effort to improve the productivity of the DIB. The IMIP is intended to meet this goal by providing incentives to the contractors for improvements in manufacturing plants and processes. Such improvements are intended to benefit the Government by fostering a modern industrial base and more economical production. This chapter will review in detail the measures taken by the DOD authorizing this tri-service effort and how the goals of this authorization have been embodied in more detailed IMIP authorizations and objectives.

B. AUTHORIZATION OF THE IMIP

A test period of the IMIP was authorized on 2 November 1982 by the Deputy Secretary of Defense with the stated goal of supporting the DOD Acquisition Improvement Plan (AIP) Initiative Number Five, "Encourage Capital Investment to Enhance Productivity." The objectives, documentation, program structure, authority, limitations, test conditions, and issues of the test were stipulated in the IMIP charter and were included as an enclosure to the authorizing letter.

The authorizing letter requested that the Navy allow Rear Admiral J.S. Sansone, SC, USN, Deputy Chief of Naval Material for Contracts and Business Management, to serve as the initial chairman of the IMIP Steering Group to be formed under the Charter. It also named Dr. Richard A. Stimson of the Office of the Under Secretary of Defense for Research and Engineering (Acquisition Management) as the Office of the Secretary of Defense representative and requested that each of the services and the DLA nominate a senior representative and alternate to the steering group. The conclusion of the letter of authorization was that, during the test period, proposed IMIP policy would be coordinated within the DOD and with industry. Also, specific recommendations for changes to the Defense Acquisitions Regulations (DAR) to support the program should be defined and the proposed IMIP policy should be developed further.

C. IMIP TEST CHARTER

The IMIP Test Charter states that the DOD is not yet in a position to propose the specific DAR changes required to improve productivity and that,

> The test is being initiated with the objective being to develop and submit specific recommendations for changes to the DAR and improvements to IMIP policy. At the completion of the Program, a formal DOD IMIP instruction will be issued. [Ref. 1: p. 1]

Improving productivity is viewed as being contingent on two factors: providing incentives for contractors to modernize their facilities and removing impediments or disincentives

for reduced unit costs on major capital investments. One disincentive specifically identified by the Charter is,

> The policy and practice of pricing contracts on the basis of costs expected to be incurred--any significant reduction in the costs of performance will cause a related reduction in negotiated profits. [Ref. 1: p. 1]

Another identified disincentive was linked to DAR 3-815 which describes a procedure for the government to accept some risks of program failure (defined as severe reduction in scope or termination of the program) in order to encourage contractor investment in severable plant equipment (that equipment which can be moved with a reasonable amount of effort). According to the Charter,

> The present application of DAR 3-815 to only severable plant equipment further diminishes DOD's ability to encourage contractor investment in necessary capital assets. [Ref. 1: p. 1]

The formation of an IMIP Steering Group and a Support Team is directed by the Charter. Tasks assigned to the Steering Group include the general monitoring of the conduct and results of the test program, as well as the more specific jobs of defining the time and scope of the test program, addressing the issue of funding, monitoring contingent liabilities, and, where more than one DOD component is involved, assisting in preparing the Memoranudm of Understanding (MOU) for the IMIP contract. The Support Team is charged with providing assistance to program and acquisition managers and to industry; conducting seminars and training; preparing and implementing DOD Component IMIP instructions for contracting,

technical, and financial matters; functioning as the focal point for coordination for joint interservice IMIPs; and maintaining a file on IMIP programs and results.

Two key documents relating to the IMIP are listed by the Charter for evaluation during the test. These documents, the draft DOD Instruction 5000.XX, "Industrial Modernization Incentives Program," and the draft DOD Guide "Improving Productivity in Defense Contracting" are directed by the Charter to be made available to appropriate Government and industry personnel and modified or added to during the test period based on the circumstances of the acquisitions concerned.

The usual procedures for obtaining DAR deviations are outlined in DAR 1-108 and DAR 1-109. For the purposes of the test, the Charter authorizes a blanket waiver to DAR 1-108 and DAR 1-109 and establishes controls to be used to prototype capital investment incentive changes, and to agreed field test changes. The procedure stipulated is that the standard DAR case format should be used for requests for deviations which may be approved by the Head of Contracting Activity (HCA) unless the request involves major policy issues in areas other than capital investment incentives or the request will affect more than one contract. In cases regarding non-capital investment incentive areas, the approval of the Deputy Under Secretary of Defense (Acquisition Management) (DUSD(AM)) will be required. For requests for deviations that will affect more than one contract, Steering

Group approval will be required. In all cases, the Steering Group will be appraised of all deviations granted, the DUSD(AM) will be appraised of all deviation activity by the OSD representative on the Steering Group and the DAR Council will be provided copies of all deviations. The Charter does not change DAR 3-815(D)(2)(ii), the provision requiring high-level approval of contingent liabilities, or the requirement that the Assistant Secretary of Defense (Comptroller) and the Under Secretary of Defense (Research and Engineering) be notified prior to contract signature on a contract contingent upon future production with a liability of ten million dollars or more.

Under the test conditions stipulated by the Charter,

> Contractors will have the opportunity to share in the Government's savings through the use of sharing arrangements or on a percentage basis, through a return on investment (ROI) approach, or through other appropriate approaches. In addition, the Government's assumption of risk for program failure would not be limited to severable plant equipment and could include investments for non-severable assets. [Ref. 1: p. 3]

The selection of programs for the test will be based on the factors described in the proposed DOD Instruction 5000.XX and the estimated potential for cost savings by the government. The proposed Charter criteria for the selection of contractors' proposals are as follows:

1. The investment would not be made, but for the government's agreement to share benefits and accept certain risks,

2. There is a reasonable expectation that adoption of the proposal will result in a substantial savings to the government through lower unit

production cost or that other benefits as stated in proposed DOD Instruction 5000.XX will result,

3. There is a reasonable expectation that funds will be available to procure the projected quantities.

4. The investment should primarily support enhanced production efficiency of an existing or anticipated operation, not new production capacity, and

5. The investment will have desirable benefits in other areas such as industrial preparedness. [Ref. 1: p. 3]

The conditions of the test further stipulate IMIP-specific information that should be included in the contractor's proposal. The additional contractor proposal information required by the Charter is as follows:

1. Identification of assets to be acquired by the contractor,

2. Identification of items to be produced,

3. Description of the differences between the contractor's production methods with and without the proposed investment,

4. Detailed cost estimates for the existing contract requirements and the proposal,

5. Analysis of effects of learning, variations of quantities, changes to make-or-buy plans, subcontracting, labor contract agreements, and other similar factors, and

6. Suggested business arrangement describing government and contractor benefit sharing over existing and future contracts and the time frame for acceptance of the proposal. [Ref. 1: p. 4]

D. PROPOSED DOD IMIP INSTRUCTION

The purpose of the "DOD Industrial Modernization Incentives Program," DOD Instruction 5000.XX, is,

> To establish the Industrial Modernization Incentives Program. This program will help focus contractor resources on industrial modernization. It will help support the development of more efficient production capability for weapon systems, equipment and material. The Industrial Modernization Incentives Program encompasses and expands on existing service programs referred to as Technology Modernization and Industrial Productivity, sets policy, assigns responsibilities, and prescribes procedures. [Ref. 2: p. 1]

From this quote, it is apparent that the purpose of the IMIP is to motivate contractors to make capital investments to upgrade equipment or plant on the assumption that so doing will result in improved manufacturing efficiency and reductions in weapon systems costs.

The proposed Instruction addresses several IMIP policy topics. The topics cover these areas: motivation of industry toward the Government's goals in this area; inclusion of the IMIP in overall acquisition strategy where applicable; and contractor investment (and if necessary, Government funding of IMIP implementation). Of these topics, that of motivating industry is addressed in the greatest detail.

Toward the goal of motivating industry to take actions that should result in improved productivity, the proposed Instruction indicates that industry should be motivated to:

1. Invest in improved processes, methods, techniques, facilities and equipment, software and organization(s), including the improved utilization of human resources, for the most efficient and economical production of quality defense weapon systems, equipment, and material;

2. Improve its productivity and responsiveness including prime contractors, subcontractors, and vendors;

3. Reduce acquisition and other life-cycle costs of defense systems;

4. Reduce lead time and increase the surge and mobilization capability of industry;

5. Accelerate implementation of advanced manufacturing technology, and provide maximum distribution of results;

6. Improve product quality and reliability as a function of the manufacturing process; and

7. Implement manufacturing systems improvements based on a long term perspective and plant-wide total systems analysis. [Ref. 2: p. 2]

The proposed instruction assigns IMIP responsibilities to the Under Secretary of Defense for Research and Engineering (USDR&E), to the Heads of DOD Components, and to DOD component acquisition and program managers. The USDR&E is tasked with two general responsibilities. The first is to ensure that IMIP policy and procedures are consistent with the goals and objectives relating to production and operational readiness, weapon systems acquisition, production management, and industrial preparedness. The second is,

> To coordinate with Congress, the DAR Council, the Assistant Secretary of Defense (Comptroller), and others, as necessary, to make effective changes to the statutes or regulations so that the IMIP may provide maximum benefits to the DOD. [Ref. 2: p. 3]

The responsibilities assigned to the Heads of DOD Components are more specific than those assigned to the USDR&E. Heads of DOD Components are responsible for ensuring that:

1. The assessment of the IMIP is in accordance with DOD Instruction 4200.15, "Manufacturing Technology Program," DOD Instruction 5000.2, "Major System Acquisition Procedures," DOD Directive 5000.1, "Major Systems Acquisitions," and DOD Directive 5000.34,

"Defense Production Management" by the proper planning, programming and budgeting of acquisitions;

2. IMIP is coordinated effectively within and among DOD components by establishing procedures for that purpose;
3. IMIP implementation is evaluated with a view to its effectiveness;
4. Contingent liability financing that may result from implementing IMIP is planned;
5. IMIP is understood and implemented at the working level by in-house training programs and by courses at schools under the control of the DOD Components and
6. Advanced manufacturing technologies are reflected in the IMIP initiatives.

The responsibilities assigned to the DOD Component acquisition and program managers are the most detailed of those assigned to the three groups. Acquisition and program managers are directed by the proposed Instruction to:

1. Ensure that IMIP opportunities are addressed in program documentation to include master program plans and supporting budget plans, acquisition plans and strategies, and source selection plans,
2. Include IMIP requirements in procurement or purchase requests for weapon systems, equipment, and material, when it is the best interest of the government,
3. Ensure that verifiable evaluation criteria, measuring tangible cost savings and benefits accrued from the IMIP projects, are established at the time of initiation, and that they are used to evaluate the effectiveness of the IMIP projects, when implemented, and

4. Act as the lead for IMIP initiatives, as mutually agreed, where more than one DOD Component acquisition or program manager is doing IMIP business with a contractor, or providing individual DOD Component IMIP requirements for inclusion when another DOD Component acquisition or program manager is the lead for the initiative. [Ref. 2: p. 4]

Nine specific procedures are presented in the proposed instruction. The procedures deal with planning for the use of IMIP, the approach to the plan, contracting, validating savings and benefits, funding, contractor investment protection, the incentives to be used, the contractor's cash flow, and technology transfer.

Planning is to be utilized for maximum effectiveness and should consider the IMIP early in the acquisition cycle.

> Normally, this consideration should be part of the industrial resources analysis required to support Milestones I and II for major weapons system acquisition. The IMIP, however, shall also be considered early in the acquisition process in other non-major systems acquisitions. This does not preclude implementing an IMIP when the acquisition cycle is at a more advanced stage. [Ref. 2: p. 4]

The approach to the plan should be in accordance with the size, scope, and complexity of the total manufacturing process, including an overall analysis of manufacturing systems for the DOD efforts being considered, comprehensive manufacturing, engineering, and plant modernization planning, and a structure and set of priorities for these efforts.

IMIP initiatives in the contracting area may be originated through requirements set forth in solicitations or mutual Government and contractor agreement before or during performance of a Government contract or class of contracts,

including flow-down of IMIP provisions to subcontractors, whether or not they participate in other IMIP arrangements. This may be accomplished by:

1. Contract provisions that affect only a single contract, a group of contracts, all contracts of a procuring activity, all contracts of a DOD Component or all contracts of the entire Department of Defense,

2. A contract with a prime contractor with flow-down to subcontractors or vendors. This shall not preclude a subcontractor from participating in an IMIP with multiple prime contractors or directly with the Department of Defense, or

3. Other appropriate arrangements as may be determined by the DOD Component involved. [Ref. 2: p. 5]

Validating savings and benefits is to be done utilizing the system developed by the contractor and approved by the DOD Component. The system must be well documented; integrated in the overall IMIP implementation plan; consistent with the manner in which the contractor collects and proposes costs; and include a mechanism that permits reporting, validating and auditing of realized cost savings and benefits.

All funding for IMIP efforts will be provided ideally by contractors; however, DOD funding may be provided when in the best interest of the Government. DOD funding may be from the individual program involved or from broader functionally oriented funding. All funding is governed by DOD Instruction 4200.15, "Manufacturing Technology (MANTECH) Program" and DOD Directive 4275.5, "Acquisition and Management of Industrial Resources."

Contractor investment protection should be provided by the recovery of funds from contract termination. When

termination does not yield sufficient funds to finance outstanding contingent liabilities which will become actual obligations, it is the responsibility of the procuring activity to ensure, before cancellation, that sufficient funds to accommodate the obligation(s) will be available.

Many incentives are available under the IMIP. Some of the primary ones are shared productivity rewards, contractor investment protection, performance incentives fees, award fees, multi-year contracts, and Government funding.

The contractor's cash flow is of importance when evaluating proposed IMIP efforts. Impediments to increased capital investment resulting from the cash flow may be eased by unusual progress payments or advance payments.

Technology transfer is the final procedure addressed by the proposed instruction.

> IMIP provisions must provide for the transfer of technology, early domestic dissemination of technical data and the control of foreign dissemination of technical data. [Ref. 2: p. 7]

E. PROPOSED DOD GUIDE TO IMPROVING PRODUCTIVITY

The draft DOD Guide, "Improving Productivity In Defense Contracting" was the second document authorized for utilization and modification during the IMIP test period.

> The objective of this Guide is to facilitate reaching a sound business arrangement whereby both the DOD and the DOD contractors can benefit through capital investments to improve productivity. [Ref. 3: Foreward]

This is reflected in the six chapters of the Guide which cover productivity-related assumptions, the concept of

Return on Investment (ROI) and methods of computing same, contract incentives as a means of reducing the uncertainty associated with defense contracts, general applications of Government technology funding, the negotiation process as a means to accomplish an objective, and the importance of benefit tracking.

> Productivity is often said to be primarily influenced by technology and capital. That is, productivity varies in almost direct proportion to the application of technology and capital. Various national studies have shown that capital and technology can account for approximately seventy percent of the rate of productivity growth. [Ref. 3: p. 1]

However, the Guide does make the point that although the productivity rate increase of the Defense Industrial Base (DIB) is declining and the cost of new weapon systems has been increasing at an exponential rate since the end of World War II, productivity is not the only cause. It is a vital element, though, and one which can be identified and attacked.

Return on Investment (ROI) is a central concept in the business community and, according to the Guide, one which should be adopted by the DOD to enable it to invest in modern cost reduction technology/equipment. As applied to DOD investments, it would involve the analysis of the investment and the stream of cash flows that are projected to be generated based on the discounted cash flow (DCF) method using the internal rate of return (IRR) methodology. The comparison of the ROI to a standard or opportunity cost

would determine whether it was in the best interest of the Government to invest with the contractor.

Contract incentives are identified by the Guide as a means of reducing the uncertainty of defense contracts, thus removing a major impediment to making cost reduction investments. Some of the uncertainties listed are the annual buy syndrome, the need for a large up-front investment with a long payback period and a slow recovery for ROI purposes. The three primary incentives introduced by the Guide to alleviate the above handicaps are the use of termination protection provisions, award fee provisions, and shared savings provisions.

The Guide presents a new perspective on the general application of Government technology funding. Government technology funding to design state-of-the-art weapon systems in the defense industry has existed for many years, but the Guide proposes that the funding be expanded to the actual methods of manufacturing the systems. This upgrade of the DIB is to be accomplished by the use of the Manufacturing Technology (MANTECH) Program, the Technology Modernization (TECHMOD) Program (The MANTECH and TECHMOD Programs are briefly introduced by the Guide. They are covered by the Guide to the level described in the remainder of this paragraph), by integrating technology provisions, and by technology transfer. The MANTECH Program will contribute to an improved DIB by initiatives which will:

1. Aid in the economical/timely production of qualitatively superior weapons systems/components in both direct and indirect manufacturing cost center areas;

2. Ensure that advanced manufacturing processes, techniques and equipment are available and will be used to reduce DOD material acquisition costs;

3. Continuously advance manufacturing technology to bridge the gap from R&D advances to limited or full-scale production;

4. Ensure that more effective industrial innovation and capital investment in new plant and equipment are stimulated by reducing the up-front cost and risk of advancing and applying new and improved manufacturing technology; and

5. Ensure that manufacturing technologies used to produce DOD material are consistent with safety, environmental, energy, product assurance, and foreign critical strategic materials dependency objectives of the DOD. [Ref. 3: p. 19]

The Technology Modernization Program is a partnership between the Government and the contractor for the application of capital and technology with the goal of increased contractor productivity and responsiveness. It generally entails a three phase effort:

1. Phase I is a top down factory analysis which both evaluates the needs of the overall facility and identifies candidate manufacturing technologies which are applicable to the types of systems produced in the factory. At the culmination of Phase I is a negotiated "business deal" between the Government and the contractor. The business deal establishes the ground rules for Phases II and III,

2. Phase II is the development of the enabling technologies and design of the factory modernization enhancements. Phase II also identifies implementation plans, specifies hardware/software operational requirements and validates specific applications through method demonstrations, and

3. Phase III is the implementation of the Technology Modernization Program, including purchases and

> installation of capital equipment to implement those Phase II candidates that demonstrate highest potential payback. [Ref. 3, p. 20]

Technology transfer is a critical element. "Special contracts provisions are required to ensure the technology established is transferable to other industry contractors. Provisions must also be included to ensure that foreign dissemination is controlled" [Ref. 3: p. 22].

The negotiation process attempts to define a sound business arrangement that includes significant benefits for the Government and the contractor. It is, according to the Guide, necessary for the eventual success of the Program and should be approached objectively looking at the methods of reaching the objective, the degree of competition, the method of calculating the ROI, the application of the weighted guidelines procedures (DAR 3-808) for profit determination, and assessing the benefits to be accrued by the Government.

Benefit tracking, or a system of validating savings, is vital because the basic justification for any manufacturing cost reduction program is the forecasted cost savings.

> A sound system for computing cost savings must be developed by the contractor and approved by the Government. This system must be well documented and based upon sound logic. More importantly, the system must be integrated into the overall factory planning system. It must be consistent with the manner in which the company collects and proposes costs. [Ref. 3: p. 28]

However, the Guide stresses that the effectiveness of a manufacturing cost reduction program cannot be judged by

validating projected cost savings, but must be measured by the actual results of the program.

F. FORMAL DESCRIPTION SUMMARY

This chapter has provided a detailed review of the measures taken by the DOD in authorizing the IMIP. The purpose of this summary is to highlight some of the key elements of the planned Program implementation.

The Industrial Modernization Incentives Program assumes improved productivity may be obtained by the application of capital and technology to the manufacturing process. The Government has been involved in the application of technology to the design of state-of-the-art weapon systems for many years, but the application of technology and capital to the manufacturing process represents a new perspective. It is not an entirely new program though, as it is based on the existing military service programs of Technology Modernization and Industrial Productivity. It differs from the existing programs because it is a formal, tri-service effort managed by the OSD and it has clearly defined objectives, policies , written procedures (the DOD Instruction "Industrial Modernization Incentives Program" and the DOD Guide "Improving Productivity in Defense Contracting"), and task assignments relating to enhanced productivity in the DIB. In addition, its implementation emphasizes concurrent management and engineering applications to further improve productivity.

Specific program policies are addressed in the DOD Instruction "Industrial Modernization Incentives Program-" The primary policy, that of improved productivity in the DIB, is viewed as the end result of the accomplishment of several objectives. Some of the goals are to improve the manufacturing process to provide for the economical production of defense material, improved contractor responsiveness, reduced life-cycle costs of defense systems, reduced lead time, increased surge and mobilization capabilities, increased utilization of advanced manufacturing technology, improved product quality and reliability, and improvements to the DIB based on a long term perspective. The presumption of the IMIP is that the accomplishment of these goals will result in improved productivity and related benefits to the DOD and the civilian sector.

The IMIP assumes that industry has not made technology-enhancing investments due to certain disincentives associated with dealing with the DOD. Two of the primary disincentives identified are a reduction in negotiated profits based on a reduction in the costs of performance and the risks, such as termination or reduction in scope, inherent in contracting with the Government. The purpose of the IMIP is to mitigate or eliminate disincentives and to motivate contractors to invest capital in technological manufacturing improvements. Some of the methods for doing this are shared productivity rewards based on a ROI approach

or on a percentage basis, contractor investment protection, performance incentive fees, award fees, multiyear contracts, and Government funding of plant upgrades.

Implementation of the IMIP is to be based on a three phase effort. During Phase I, both a top down factory analysis of the prospective contractor and an analysis of the applicable manufacturing technologies are evaluated by established criteria for selection to participate in the Program. The criteria for selection are that the contractor would not, under normal conditions (not participating in the program) make the investment, there is a reasonable expectation that the Government will benefit from the arrangement, full funding for the projected quantities is expected, the investment will improve the productivity of the base and not support new production capacity, and other benefits to the Government will accrue. For contractors selected to participate, the conclusion of Phase I is a "business deal" with the Government that outlines the basis of Phases II and III and describes funding responsibilities. Funding will normally be provided by contractors, but, if it is in the best interest of the Government, DOD may provide funding. During Phase II, method demonstrations are to be used to validate specific applications, operational requirements are to be identified and enabling technologies and factory/equipment designs are to be developed. In addition, projected cost reductions are to be determined at this time.

In Phase III, the final step, the physical actions necessary to implement the program in the plant are to be accomplished. The task of evaluating implementation in the area of effectiveness is assigned to the Heads of DOD Components and is to be done utilizing the contractor designed system approved by the DOD Component in Phase I. This validation and audit of realized cost savings and benefits is one of two factors to be used to measure effectiveness. The other factor is a subjective analysis of the actual success of the program.

Key players are identified and tasked with both general and specific responsibilities by the IMIP. The USDR&E is tasked with managing the program and coordinating it within the various branches of the Government. Heads of DOD Components have the more specific tasks of assessing the IMIP, coordinating it within the DOD, evaluating its implementation, planning for financing contingent liabilities, and ensuring that the program is implemented and understood at the working level. DOD Component acquisition and program managers are assigned detailed, technical responsibilities within their respective areas. Tasks regarding the initial design, implementation, and development of the IMIP are assigned to the two groups formed by the Charter, the Steering Group and the Support Team. Some of the primary responsibilities assigned to the Steering Group are monitoring the conduct and results of the test program, defining the time and scope of the test, addressing the issue of funding and

monitoring contingent liabilities. The Support Team is tasked with assisting DOD managers and industry, the preparation and implementation of instructions, coordinating joint interservice IMIPs, and the maintenance of an IMIP program and result file.

III. STATUS OF THE IMIP IMPLEMENTATION

A. THE CONCEPT ACQUIRES SUBSTANCE

The primary objective of the IMIP is to:

> Develop and refine contract incentives which encourage defense industries to use their own funds for productivity-enhancing capital investments. [Ref. 4: p. 42]

While this objective is conceptually simple, it is extremely complex in application. To provide an understanding of the implementation status of the IMIP, this chapter addresses the current status of several developments upon which the success of the Program depends. To accomplish this, the activities of the individuals providing guidance to the Program are explained, the types of contracts to which the IMIP is considered applicable are outlined, the Program's perceived relationship to the AIP is explained, the time period of the test is explored, sources of funding are discussed, dissemination of Program information at the working level is addressed, the discounted cash flow model as it applies to the IMIP is reviewed, and old and new IMIP partnerships are defined. The conclusion of the chapter is a brief summary of the above listed topics and other relevant, but minor points of interest regarding the implementation of the Program.

B. IMIP GUIDANCE

The Industrial Modernization Incentives Program is being implemented under the guidance of a Steering and a Working

Group. As requested in the IMIP Authorization Letter, the Navy selected Rear Admiral J.S. Sansone, SC, USN, to serve as the initial chairperson of the IMIP Steering Group. Dr. R.A. Stimson, Director of the Office of Industrial Productivity, represents the Office of the Secretary of Defense (OSD) on the Steering Group; the Army is represented by Major General R.L. Herriford, Sr., USA, Director of Army Procurement and Production; the Air Force is represented by Brigadier General B.L. Weiss, USAF, Director of Air Force Contracting and Manufacturing Policy; and the Defense Logistics Agency (DLA) is represented by Major General J.H. Connolly, USAF, Deputy Director, DLA Acquisition Management.

The IMIP Steering Group convenes quarterly or on an as-required basis to address IMIP issues.

> The focus of the meetings to date has centered on DOD Component organization of the IMIP test, development of implementation plans, and maintaining overall visibility over the test. [Ref. 5: p. 2]

The Support Team, now referred to as the Working Group, is chaired by Commander J.F. Hering, SC, USN, Special Assistant to the Deputy Chief of Naval Material for Contracts, and staffed by personnel from the Navy, Air Force, Army, DLA, Defense Contracts Administration Agency (DCAA) and OSD. The Working Group meets monthly or on an as-required basis, at which time it approaches IMIP related issues by the use of a formal agenda that is promulgated to the members prior to the meeting by the Chairperson of the Working Group. During the meetings, issue papers on IMIP

topics prepared by the Group members are discussed; committees comprised of Group members present findings and make recommendations on subjects that are considered too complex or involved for initial consideration by the entire Group; external, independent experts speak on IMIP related subjects; decisions are made by group consensus; and new IMIP areas are introduced.

Enthusiastic support of the IMIP and an in-depth comprehension of the Program by the Support Team is essential if the concept is to succeed. Based on first hand observation of the Support Team, most notably attending a meeting of the Team on 27 August 1983, it appears that these qualities are present in those involved with the IMIP guidance.

C. IMIP APPLICABLE CONTRACTS

It is recognized by those providing the IMIP guidance that the Program is not applicable to all DOD contracts. In addition to the criteria for selection of contracts described in Chapter II, there are other factors that might preclude inclusion in the IMIP. Some of these factors are the wrong type of manufacturing process, a small projected dollar value of the program, an unstable program, or consequent adverse effects to competition.

The primary application of the IMIP is to assembly line type operations where improvements in output or reductions in input can be measured. It would be difficult, if not

impossible, to apply the Program to shipbuilding or other industries where each end item is different.

The IMIP is not economically feasible for low dollar value contracts. The Government would not profit because the IMIP savings would be offset by increased contract administration costs. The contractor would likewise have increased costs, difficulty in obtaining an adequate ROI, and would face an impossible task in tracing and verifying costs if they represent a small portion of his business.

A stable program is required for the IMIP. Projected savings cannot be determined unless there is a solid projection of the size and scope of the program. This is especially important to the Government because, under an IMIP arrangement, the Government assumes most of the risk associated with reduction in the total amount of the contract.

It is not the intent of the Program to stifle competition within the DIB. In that regard, an effort will be made to give all contractors in a competitive environment equal access to the benefits associated with the IMIP.

D. RELATIONSHIP TO THE ACQUISITION IMPROVEMENT PROGRAM

The stated goal for which the IMIP was initiated is to support the DOD Acquisition Improvement Plan (AIP) Initiative Number Five, "Encourage Capital Investment To Enhance Productivity." It continues to be officially backed for this purpose. This is demonstrated in the "AIP Second Year

Report" of 18 May 1983 included in the Deputy Secretary of Defense Memorandum of 8 June 1983, "Guidance on the AIP." In the Report, the IMIP is listed as one of the mechanisms to encourage capital investment by DOD contractors to increase their productivity with the recommendation that:

> OSD and the Services should continue to actively encourage and support the test of the IMIP which is underway. USDRE should report progress on the Program to the DEPSECDEF quarterly. [Ref. 6: p. 7]

E. TEST PERIOD EXTENSION

The initial IMIP test period did not have a scheduled completion date (the specific job of defining the time of the test program was assigned to the Steering Group by the IMIP Test Charter), but a period of one year was generally understood to be implied by the IMIP implementing documents. The time frame of the test period has since been addressed by the Steering and Working Groups and extended beyond one year. As the result of a 21 June 1983 request from the Joint Logistics Commanders to complete the test within nine months, an extension of the test period was considered.

> This extension (from December 1983 to March 1984) of the original...test schedule will allow more in-depth analysis of the complex issues surrounding IMIP. [Ref. 8: p. 1]

Subsequent to the move to extend the test to March 1984, the Working Group decided that more time would be required for the test. As of this writing, a firm completion date for the test has not been determined, but late 1985 is

considered by the Support Team to be a likely time for the conclusion of the test.

F. IMIP FUNDING

As discussed in the previous chapter, IMIP funding will normally be provided by contractors, but, if it is in the best interest of the Government, DOD may provide funding. The sources of DOD funding and interim policy guidance regarding the use of financial resources for implementing the IMIP were specified by a USDR&E memorandum on the subject dated 17 June 1983. According to the USDR&E and the Assistant Secretary of Defense (Comptroller),

> Direct Government funding may be provided from the individual acquisition programs involved, or from the appropriate categories of Program Element (PE) 78011, "Industrial Preparedness." Attached is a revised PE description for PE 78011, which adds a new sub-element for IMIP activities not currently provided for. The categories and preferred sources of IMIP funding are shown in the attached table. Procedures outlined in DUSD letter dated 2 November 1982 (discussed in Chapter II, Section B), and/or the requirements of DAR 3-815 will be followed. [Ref. 8: Attachment]

SOURCES OF FUNDING
FOR
INDUSTRIAL MODERNIZATION INCENTIVES
PROGRAM (IMIP) ACTIVITIES

	SOURCE OF FUNDS IN ORDER OF PREFERENCE			
DELIVERABLE	CONTRACTOR	WEAPONS SYSTEM/ SYSTEM	STRUCTURED ANALYSIS/ APPLICATIONS ENGINEERING*	MFG* TECH
Technology--Application Engineering				
Single weapon system	1st	2nd	No	No
Multi weapon system	1st	2nd	3rd	No
Technology--Advance State-of-the-Art				
Single weapon system applications	1st	2nd	No	No

Multi weapon system-- 1 facility application	1st	3rd	No	2nd
IMIP Structured Analysis	1st	2nd	3rd	No
Incentive Awards Single or multi weapon system	NA	1st	No	No
Capital Equipment (Off-the-Shelf) Single or multi weapon system	1st	No	No	No

*Sub-element of PE 78011, "Industrial Preparedness"

[Ref. 8: Attachment]

The USDR&E quote and table indicate that in all cases, except Incentive Award contracts for single or multi-weapon systems, the primary source of funds should be the contractor. Secondary sources are determined by the type of deliverable and vary between the individual acquisition programs and PE 78011.

The USDR&E IMIP Funding memorandum not only represents an expansion of PE 78011 to include a sub-element for IMIP related activities, but also provides policy on funding applications. By so doing, a flexible IMIP funding policy is established.

G. DISSEMINATION OF IMIP INFORMATION AT THE WORKING LEVEL

One of the tasks charged to the Support Team by the IMIP Test Charter is to provide training and assistance to program and acquisition managers and to industry. Industry has been appraised of the concept and status of the IMIP by industry conferences sponsored by the National

Security Industrial Association and by the distribution of IMIP information packages to industry associations. Acquisition and program managers have been kept informed on the IMIP by DOD Components.

> DOD Component information packages and implementation plans have been developed and distributed to field activities. Initial DOD Component training sessions have been held to introduce the concepts and procedures to the wide variety of personnel at various levels within the organizations necessary to support development of IMIP agreements. The Navy is taking a somewhat unique approach by establishing formally designated multi-disciplined IMIP teams in its field commands. [Ref. 9: p. 2]

H. CASE-STUDY APPROACH TO IMIP DEVELOPMENT

Future policy development is intended to be based on the effects of various incentives and their motivational aspects as observed during the IMIP test and documented by the case-study approach. The task of developing appropriate case studies is assigned to the Logistics Management Institute (LMI). The General Dynamics (F-16) and Westinghouse (multi-program) agreements developed under the Air Force Technology Modernization Program (the precursor to the IMIP), and included in the Air Force segment of the IMIP test, are targeted for the initial analysis of the IMIP issues. Draft analyses on the aforesaid agreements were submitted by LMI in July 1983 and are presently being reviewed by the Air Force. The case study approach for documenting on-going efforts and analyzing the complex issues involved is perceived as the single most important aspect of the IMIP test. Key issues being analyzed are:

> Compilation of detailed contract status sheets; development of an initial series of issue papers to crystallize ideas, foxus attention, and ensure a common understanding of issues; and refinement of a ROI model. [Ref. 5: p. 4]

With the exception of the refinement of a ROI model, the key issues have yet to be firmly defined.

I. THE DISCOUNTED CASH FLOW MODEL

As discussed in the Guide, the generally accepted method of computing the ROI resulting from an individual capital investment is by the discounted cash flow (DCF) method. This method, based on the internal rate of return (IRR) methodology (the IRR is the after-tax earning power of an investment and is the discount rate that makes the present value of all cash inflows equal to the present value of all cash outflows), has been developed into a "spread sheet" program by LMI. This program differs from the standard DCF models used in the civilian sector in that it takes into account the effect of Cost Accounting Standards (CAS) 409 and 414.

CAS 409, "Depreciation of Tangible Capital Assets," has as its stated purpose:

> To provide criteria and guidance for assigning cost of tangible capital assets to cost accounting periods and for allocating such costs to cost objectives within such periods in an objective and consistent manner... [Ref. 10: p. 189]

The result of CAS 409 on the LMI model is that a contractor, based on the original acquisition cost of an asset and its

service life, is directly reimbursed for depreciation under a government contract.

CAS 414, "Cost Of Money As An Element Of The Cost Of Facilities Capital," has as its stated purpose,

> To establish criteria for the measurement and allocation of the cost of capital committed to facilities as an element of contract cost... [Ref. 10: p. 250]

Thus, the effect of CAS 414 on the LMI model is a cash in-flow resulting from the reimbursable cost of money imputed in accordance with DAR 15-205.50 (a), "Facilities Capital Cost of Money."

A sample output of the LMI model is included as Appendix A. It uses numerical values similar to the IMIP Guide demonstration model, a contractor ROI target of 20 percent, and assumes a productivity savings at 30 percent with a contract duration and life of equipment of 9 years. Initial investments are $100M from the contractor and $10M of direct Government funding. Positive cash flows are shown for the items of Imputed CAS 414 Interest (the interest rate is variable, but the net book value under CAS 409 is the basis for the computation), Profit of Facilities (the net book value is derived under CAS 409 and the rate is obtained from the Weighted Guidelines (DAR 3-808.7)), CAS 409 Depreciation (based on the Sum-of-Years/Half Year Convention), and Profit on Depreciation (depreciation expense, as an allowable contract cost, bears a profit that is adjusted to 70 percent of the gross amount). Negative cash flows are

evidenced by Profit on Savings (this represents profits lost due to reduced costs of production), Accelerated Cost Recovery System (ACRS) Depreciation (the method used by the contractor for income tax purposes), and Income Tax. Under the parameters presented, assuming shared savings, and taking advantage of an investment tax credit the first year, the contractor would experience an ROI of 20 percent with a 2.7 year payback period; the DOD would experience a 15.2 percent ROI with a 6.9 year payback period; and the Government would experience a 27.7 percent ROI with a 5.3 year payback period. Rates vary between the DOD and the Government because tax effects applicable to the Government do not pertain to the DOD.

J. EXISTING IMIP PARTNERSHIPS

Prior to the implementation of the IMIP, the Air Force and Army had on-going productivity programs under the Air Force Technology Modernization (TECHMOD) Program and the Army Industrial Productivity Incentive (IPI) Program. These programs have been continued as part of the IMIP test, but have not been renamed due to various factors, such as the concern voiced by the services that renaming ongoing programs might confuse contractors, the desire to retain more control over service programs than would be possible under a DOD program, and variations in the approach to funding between the services and the DOD. Although the Air Force and Army arrangements predate the IMIP, it may be stated

that the Air Force has IMIP type partnerships with General Dynamics, Westinghouse, Rockwell International, Boeing Military Aircraft, Pratt and Whitney, General Electric, Hazletine, Sonicraft, Hughes Tucson, and GELAC/AVCO; and the Army has a similar partnership with AVCO-Lycoming and Harris Corporation.

K. IMPLEMENTATION STATUS OF NEW IMIP PARTNERSHIPS

The Navy, which had no IMIP-type arrangements prior to the implementation of the Program is progressing with several efforts. The Naval Air Systems Command (NAVAIR) is currently in Phase I with Northrup and Hughes Aircraft and will soon enter Phase II with Grumman by signing a Memorandum of Agreement (MOA) with the company. The Naval Sea Systems Command (NAVSEA) has been in Phase II since the signing of a Memorandum of Understanding (MOU) with General Dynamics, Pomona Division, and its subcontractor, Thiokol Corporation, on 8 September 1983. This initial Navy MOU between NAVSEA, General Dynamics, and Thiokol is the first DOD ground-up application of the IMIP, and as such, is a significant step in the application of the Program by the tri-service team.

The basis of the NAVSEA MOU (included as Appendix B) is that Thiokol, as the subcontractor to General Dynamics, will invest its funds in productivity enhancing facility improvements, and that NAVSEA will share the savings with Thiokol. According to the MOU,

> General Dynamics, as long as it is the prime contractor for the MK 104 Dual Thrust Rocket Motorr, will manage, monitor, audit, and maintain overall cognizance over the incorporation of up to approximately seven million dollars of improvements to facilities by Thiokol, including new equipment and engineering management applications, to improve overall productivity through advanced technologies which will reduce the production costs of the MK-104 Dual Thrust Rocket Motor...
>
> NAVSEA will provide the opportunity for Thiokol Corporation to recoup its investment and a reasonable return thereon, through shared savings based upon baseline prices to be negotiated. [Ref. 11: p. 1]

The Government reserves the right to terminate the IMIP MOU in the event that the production of MK-104 motors is completed or Thiokol loses the competition prior to the recovery of depreciation for the IMIP related facility improvements. In that event, termination protection is provided to Thiokol in the not-to-exceed amount of Government liability of the following table taken from [Ref. 11: p. 2]:

GFY 83	$295,000
GFY 84	2,726,000
GFY 85	3,712,000
GFY 86	582,000
GFY 87	-0-

It appears that this abbreviated (three page) MOU contains the basic elements required under the IMIP, such as an incentive for the contractor to upgrade his plant, a means whereby the Government can release itself from the arrangement, and termination protection for the contractor.

The potential IMIP MOA between NAVAIR and the Grumman Aerospace Corporation is much more detailed than the NAVSEA

MOU. This MOA, which is anticipated to be signed soon, is comprised of the following eight sections:

1. Introduction and Background,
2. Purpose,
3. Definitions,
4. NAVAIR Commitments,
5. Grumman Commitments,
6. Terms and Conditions,
7. Administration, and
8. Technology Transfer and Subcontractor IMIP Flow-Down.

In the first section, the "Introduction and Background," the MOA provides the information that:

> As a deliverable end-item of Phase I, Grumman submitted a proposal in March 1983, which presented Phase I results and the rationale for NAVAIR authorization to proceed to Phase II and Phase III. [Ref. 12: P. 1]

The "Purpose" section discusses the IMIP Business Arrangement between Grumman and NAVAIR for Phases II and III as well as establishing the MOA as the basis for any future arrangements. It also identifies the applicable contracts and states that the framework for sharing risks, costs, and savings will be described later in the Agreement.

The section on "Definitions" is next. Most of the twenty terms defined are routine and are listed only as points of clarification. Others though, such as Contractor Investment, Validation, Implementation Phase, Implementation Costs, and Government Business Base are noteworthy as they are unique to the IMIP. Contractor Investment is defined as:

> Expenditures by the contractor of dollars, materials, services, or labor for IMIP identified projects. Such contractor expenditures may be considered investment only if they would be capitalized according to the contractor's standard accounting procedures or expensed against retained earnings. [Ref. 12: p. 2]

Validation is defined as:

> The procedure to establish the readiness to implement a particular IMIP project and the magnitude of cost savings which will be realized on that project. Validation is considered part of the development phase of the program and will be in accordance with a Government approved plan. [Ref. 12: p. 3]

Implementation Phase is defined as:

> The phase of IMIP in which a developed and validated IMIP project is incorporated into the production facility and includes the period of transition from the old or "As Is" production method to the new or "To Be" production method. The implementation phase for a particular IMIP project is completed when that IMIP project is completed when that IMIP project is on-line. [Ref. 12: p. 4]

Implementation Costs are defined as:

> Those Government and contractor costs exclusive of contractor capital equipment costs that are required to implement an IMIP project into the production facility (contractor cost) and onto a particular hardware contract; e.g., special tooling and test equipment, etc. (Government costs). [Ref. 12: p. 4], and

Government Business Base is defined as:

> That portion of the Contractor's firm and projected business which will be considered for determining the Government's benefits from IMIP improvements. Foreign military sales related to IMIP improvements are also included. [Ref. 12: p. 4]

"NAVAIR Commitments" are limited to two statements of intent. The first is that NAVAIR intends to order under the applicable contract in accordance with projected Government funding. The second is that, if NAVAIR's budget is reduced below the projected funding level in one (or more)

year(s), the IMIP funding will be reduced by no greater a percentage than the percentage reduction of the overall NAVAIR budget for the year(s). The point is also made that if funding is reduced, the IMIP target ROI of each affected IMIP project will be increased by an amount to be determined.

In the section titled "Grumman Commitments," the company addresses four issues. The first is a statement of Grumman's intention to complete a "Production Modernization Program" and to tailor certain funding of that program to implement improvements developed and/or validated under the IMIP. The second is the agreement to fund approximately 50 percent of the Phase II costs and the identification of the potential sources of those funds. The third issue is a statement that project development funding will be identifiable through the company's cost accounting procedures and verifiable by the Navy's in-plant representative, and an agreement to collect and segregate costs on IMIP projects when practical. The final issue is an agreement that, in the event of a curtailment of NAVAIR funding resulting in an increase in the ROI, Grumman will provide additional funding to complete in-process task orders at the price previously negotiated.

The "Terms and Conditions" section is divided into subsections on Direct Labor Hour Savings Determination, Other Cost Saving Determination, Savings Validation, and Savings Sharing.

The "Direct Labor Hour Savings Determination" subsection describes how the direct labor baseline will be established

from projected system cost data based on the learning curve slope derived from actual cost data and cost element analysis. This baseline will then be proposed to each Primary Contracting Officer (PCO) involved for negotiation.

> The negotiated system direct labor baselines will be incorporated into this MOA and will form the reference from which all savings under the IMIP generated by direct labor hour reductions will be measured. [Ref. 12: p. 9]

Baseline adjustments will be proposed annually by Grumman, then negotiated, and agreed to by both parties. These adjustments are considered to be necessary to reflect the changes in design, specifications, make-or-buy, or production rate.

The "Other Cost Savings Determination" subsection deals with the determination by Grumman of other cost savings resulting from IMIP projects.

> The savings determination will be made by comparing the "As Is" method of application with the "To Be" method during each IMIP project validation. The savings value established for each system will be added to the direct labor hour savings... [Ref. 12: p. 10]

The subsection on "Savings Validation" outlines the specific validation procedure which is that, no later than six months before the end of the development phase of each IMIP project, Grumman will propose a procedure, and NAVAIR and Grumman will mutually agree on it. The guidelines of the validation procedure are that it must identify and project both direct labor costs and savings of other costs.

The "Savings Sharing" subsection explains that:

> The cost savings share to be received by Grumman represents the incentive for Grumman to expend capital funds

> for cost reductions and industrial modernization through IMIP projects instead of for other purposes. Accordingly, a performance incentive will be structured so that Grumman and NAVAIR both benefit from IMIP cost reduction. Only savings generated by IMIP efforts covered by the MOA are to be used for recovery of investment and ROI realization. [Ref. 12: p. 12]

In addition, this subsection specifies that to qualify for full savings sharing, Grumman must complete the facility and technology implementation on schedule and achieve the projected savings. A 50/50 basis will be utilized for savings sharing for the time (not to exceed five years) required to provide Grumman with the target ROI for each IMIP project. The target ROI will be computed using the DCF model. The sharing ratio may be adjusted as necessary in the event the target ROI cannot be achieved within five years on an IMIP project. Data for computation of the ROI on the DCF model will be supplied to NAVAIR for negotiation at the time of project savings validation.

The "Administration" section is divided into subsections on the Relationship of the Parties, Cost Savings, and Contract Adjustments.

In the "Relationship of the Parties" subsection, the period of the direct contractual relationship is delineated as at least five years, the method of maintaining the relationship is specified as a Basic Ordering Agreement (BOA), and the Navy is designated as the lead DOD service in the event other Government agencies become involved. As the lead service, the Navy, represented by NAVAIR, is tasked with

establishing appropriate agreements between all participating Government agencies and the negotiation and administration with Grumman of individual IMIP project proposals.

Cost Savings, as they apply to NAVAIR, are to be calculated by converting validated direct labor savings and other cost savings into then year dollars on a yearly basis. This amount should then be credited to NAVAIR by reductions in current contracts and the pricing of future contracts.

Contract adjustments, the means whereby cost savings will be passed to NAVAIR, may be applied to current contracts (Firm Fixed Price (FFP) or Fixed Price Incentive (FPI)) and future contracts. The price of FFP contracts is to be reduced by 100 percent of the validated cost savings while the target price, target cost, and ceiling price of FPI contracts are to reflect a reduction of 100 percent of the validated cost savings projected. The share of the savings projected allocated to Grumman will be set aside as a performance incentive payment. Future contract proposals should be based on, and show, cost benefits anticipated to accrue due to IMIP improvements. Implementing language for future contracts is also included as Special Provisions under the Contract Adjustment subsection. Termination of Project is the final subject covered by this subsection. According to the MOA:

> During the course of performance of this Phase II effort under any given IMIP project either party may terminate the project if a written technical determination can be made that the project is not successful. Such

> determination will be made at no fault to either party and that order may be terminated at no cost to either party. Such determination may not be made solely because of lack of Government funding or inability on the part of Grumman to implement the project within the fixed dollar amount of the task order. [Ref. 12: p. 19]

"Technology Transfer and Subcontractor IMIP Flow-Down" is the concluding section of the MOA. In this section, Grumman agrees to the transfer of IMIP related technology developments throughout the aerospace industry, to maintain comprehensive documentation on each technology related advancement project, and, by the means of conferences, meetings, and solicitations, to encourage subcontractors, suppliers, and vendors to participate in the IMIP.

L. IMIP STATUS SUMMARY

Significant progress has been made in implementing the IMIP since it was authorized on 2 November 1982. Steering and Support Teams have been organized and are operating on a routine basis to organize the IMIP test, address related topics, resolve current issues, and plan future actions. The tri-service teams have successfully solved most of the initial implementation problems and are moving on to the more complex areas of changes to the DAR and adapting the IMIP to a competitive environment.

The method by which the Program will be evaluated has been established as the case-study. The first case-studies of the pre-IMIP TECHMOD arrangements between the Air Force and General Dynamics and the Air Force and Westinghouse have

been submitted by LMI and are currently under DOD review. LMI has also developed a DCF model. This model, which differs from standard DCF models used in the private sector by taking into account the effect of CAS 409 and 414, will be used to evaluate contractor proposals and projected ROIs prior to entering into IMIP arrangements.

IMIP-type arrangements that preceded the IMIP, such as the Air Force TECHMOD and the Army IPI, have been continued and are now included under the IMIP umbrella. New business arrangements have been instituted by the Navy as evidenced by the NAVSEA MOU with General Dynamics and Thiokol and the pending NAVAIR MOA with Grumman.

The IMIP test is progressing in a consistent, step-by-step manner. Numerous preliminary problems of the Program have been overcome by the teams, but it is recognized that many major issues, such as developing an objective method to measure the success of each contract, have yet to be resolved.

IV. HISTORICAL ELEMENTS OF THE IMIP

A. OVERVIEW

The driving force behind the rapid government and industry acceptance of the IMIP was its conceptual simplicity and its almost universal appeal as a solution for major governmental problems. Some of these problems have been in the forefront of public interest and have plagued government for decades.

Problem elements which the IMIP addresses directly or indirectly include:

1. Productivity,
2. Rising Weapon Systems Costs,
3. Declining Industrial Base and DOD Profit Policy.

In each problem element, the IMIP provides apparent solutions which cater to the political, social, and material needs of government, the populace, and industry. The following sections develop these elements and show significant historical events to explain how each element is associated with the IMIP.

In presenting the elements above, there is considerable overlap in the conceptual format. For example, productivity and DOD profit policy directly affect weapon systems costs, and the declining industrial base is affected by productivity and DOD profit policy. Therefore, identical historical events can, and will, be presented in each applicable

section. An effort has been made, however, to eliminate redundancy wherever possible.

B. PRODUCTIVITY

1. Understanding Productivity

Every society is faced with the problem of resource scarcity, due to an infinite desire for goods. It is productivity as applied to the scarce resources that determines the amount of goods produced. Productivity is generally measured as output per unit of resource input [Ref. 44: p. 193]. As greater output is achieved per unit of resource input, societal wealth is created. This produces increases in the standard of living. For example, assume society A has 100 lbs. of resources which it is capable of manufacturing into 15 units of marketable finished goods, and society B has an identical 100 lbs. of resources which it is capable of manufacturing into 20 units of marketable finished goods due to some form of manufacturing or management advantage. (This advantage could be attributed to more efficient capital, labor, technology, various allocations thereof, or relative size advantage.) Given that the market price of a unit of finished good is $20, it is obvious that society B has $400 of collective welath compared to society A's $300 of collective wealth. Better productivity has created an additional $100 of wealth for society B which it may use to directly improve its standard of living or to re-invest to further increase productivity. This increased

wealth also increases government tax revenues in most tax systems.

This basic example illustrates why the government constantly attempts to improve productivity or to provide an environment which is conducive to productivity improvements. If the government succeeds, it is a political victory since it simultaneously raises the overall standard of living and broadens the tax base. An annual 2 percent increase in output per manhour of labor, as a measure of productivity improvement, doubles the output per manhour every 35 years. Since World War II, the United States has experienced productivity growth of approximately 3 percent per year. This rate doubles output every 23 years [Ref. 44: p. 193].

Productivity is a complicated subject despite the simplistic modeling indicated above. Understanding productivity can be difficult at best. Mr. Edward F. Denison, Senior Fellow- The Brookings Institution, was probably as successful as most in his attempt to define the scope of productivity "...to inquire into productivity is to investigate almost every aspect of economic life" [Ref. 13: p. 114].

Productivity is influenced by a number of determinants. In attempting to present the major determinants of productivity, it is necessary to sift through a variety of theories and select the most comprehensive list which is considered to be acceptable by current economists. The following list is presented from that perspective:

1. Capital,
2. Labor,
3. Advances in Knowledge,
4. Allocation of Resources, and
5. Economies of Scale. [Ref. 14: p. 22]

The substitution of capital for labor will increase productivity, given that the substituted capital is more efficient. With a rapid rate of technological advance, it is generally assumed substituted capital will be more efficient. Efficiency of capital can be characterized by an output per time period increase, an associated labor decrease, a better product, reduced maintenance and energy costs, or any combination of these.

Productivity of labor is generally related to training, education and motivation. Labor productivity deals specifically with output per unit of labor time. The greater output per unit time, the greater productivity is achieved. Professional training and general education level of labor are recognized factors of labor productivity which can be manipulated to improve productivity. However, it is possible to have the optimum in training and education but experience low productivity, related to low motivation. Labor motivation is a sensitive problem which requires skillful handling by management, labor leaders, and any intermediaries. Problems with labor motivation do not lend themselves to universal solutions. Even apparently identical labor

motivation problems will not require the same corrective actions.

Technological advances provide a pool of knowledge from which to apply ideas which have the potential to improve production efficiency. Advances in knowledge are dependent upon two basic factors: monetary capital channeled to research and development, and information dissemination. Greater spending on research and development creates a greater pool of technology to draw upon for productivity improvement. Dissemination of technology via information systems is of primary importance to get technological advances out of the laboratory and into an environment where they can be applied and adapted. Greater dissemination realizes greater applications and increased productivity gains.

Resources include raw materials, capital, and labor. If misallocation is present, the production is not efficient. Given that the state of technology is constant, better quality raw materials alone could increase productivity. Fluctuations in the levels of capital and labor employed will affect productive efficiency. Even the reorganization of production (existing capital and labor) may yield productivity gains.

The economy of scale determinant technically implies that there is a cost advantage of a seller or group of sellers in some production area. This cost advantage could be the result of patents or wholly-owned resources, knowledge

obtained by doing (e.g., experience or learning curve effect), or even well-established reputations, credit ratings, etc. These cost advantages represent barriers to potential entrants since they give the seller an average cost curve in production which is the lowest in the marketplace [Ref. 14: p. 24].

2. Recent Decline in Productivity Growth

To view the decline in productivity growth, it is necessary to go beyond broad input/output indicator figures of Gross National Product (GNP) published by the Department of Commerce. The decline in productivity growth must be defined in terms of the average result of individual productivity advances and declines across the entire industrial spectrum. Productivity declines have not been experienced in all industries.

In addition, productivity decline is a misnomer in that industry, as a whole, is continuing to experience annual productivity growth. The point is that the percentage of annual growth has declined in the period since the mid-60's. This is in contrast to the annual growth experienced from 1948, when the Department of Commerce first began publishing the statistics, to 1966. It is well established that a decline in the rate of productivity growth has occurred, not a decline in productivity. Edgar R. Fiedler, Vice-President for Economic Research, The Conference Board, states that "the most important and most contentious (national) issue is the retardation in the trend of productivity

that has taken place since the mid-60's" [Ref. 14: p. 1]. The concern is not only that the retardation is slowing growth in our standard of living, but also that this period of retardation may lead to actual productivity declines in the future.

Kendrick and Grossman in their work, "Productivity In The United States," analyze Total Factor Productivity (TFP) as a conceptual measure of productivity and trace causal factors for the recent decline in productivity growth. They use TFP to supplement their analysis of the Bureau Of Labor Statistics estimates of output per labor hour. TFP is a more informative measure in that it provides information regarding intermediate input savings and efficiencies achieved. Appendix C illustrates their breakdown of causal factors contributing to the decline in productivity growth.

Kendrick and Grossman conclude that volume related factors accounted for about 50 percent of the slowdown (due to the aborted recovery from the 1974-75 recession), slower advances in applied knowledge accounted for about 20 percent of the decline and the other 30 percent is accounted for by changes in the quality of labor and land, resource reallocations, net government impact, and residual factors.

The components of advances in applied knowledge in the Kendrick and Grossman study are cost reducing innovations, learning curve effects through new products streams, and the rate of diffusion of new technology through changes in the average age of business fixed capital. Kendrick and

Grossman note that research and development outlays showed a decline over the period 1966-76 and that research and development was the only regression variable which had a significant and stable relationship with productivity over the two subperiods analyzed, 1948-66 and 1966-76. Additionally, the estimates of the average age of real business stocks of structures and equipment declined an average of 3 years during the period 1948-66, but an average of only 1 year during the period 1966-76. This would seem to indicate, for various reasons, a reluctance to invest in equipment resulting in aging capital equipment and slower productivity growth. Reluctance to invest in research and development decreases the pool of technological advances available for application.

3. Chronology of the Productivity Issue

Productivity has been placed in a position of importance in government for many years. However, due to the complexity of examining productivity, targeting improvements, and adhering to a cost-based profit policy, attempts to increase productivity growth have floundered. Indeed, on the national level, the complexity of productivity and the economic consequences of corrective actions is the primary reason for lack of a consistent, coordinated policy statement on the subject.

In 1968, at the peak of the Vietnam conflict and large DOD budgets, the Rand Corporation published a comparative study of negotiated contracting in the United States

and the United Kingdom and concluded that "The U.S. discriminates against capital intensive firms" [Ref. 15: p. 45]. This discrimination was manifesting itself in lower productivity throughout the Defense industrial base. Incentives for capital investments were dealt a heavy blow with the enactment of the Tax Reform Act of 1969 which lowered middle and low income households taxes and transferred the burden to business corporations and individuals in high-income tax brackets. Additionally, this legislation terminated the Investment Tax Credit (ITC) introduced during the Kennedy administration.

The opening of the decade of the 1970's did not bode well for future productivity increases. The budget deficits, tax increases, Vietnam conflict slowdown, and national public mood combined to set the stage for an unprecedented event in the United States. Indications of productivity declines began surfacing; in 1969-70, productivity growth fell to its lowest levels in the postwar era. The Wall Street Journal reported that "...businessmen have pared their 1971 capital spending plans and are scheduling the smallest rise in outlays in a decade...significant scaledowns in spending plans were registered for aircraft...industries..." [Ref. 16: p. 3]. In response to these alarming concerns, President Nixon established the National Commission on Productivity in 1970 stating "No other single national goal is more important to the American at present and future than new

standards for revitalizing American productivity" [Ref. 13: p. 6]. The Commission's second annual report recognized the importance of capital investment and research and development and noted that during 1970-71 Japan annually plowed back into investment 38 percent of its total GNP, more than twice the United States rate of 18 percent, and Japan's gross private investment in new plant and equipment during this period was 20 percent of GNP while the U.S.'s was 10 percent [Ref. 17: p. 18]. In April, 1972, the Honorable Charles H. Percy, member of the Subcommittee on Priorities and Economy in Government, summarized the productivity situation in three points:

1. It is essential to strengthen U.S. international competitiveness which has been weakened by chronically low productivity rates. In the late 1960's, while Western European industrial nations increased manufacturing output by 40 percent to 50 percent, and Japan by 90 percent, U.S. manufacturing output increased by only 10 percent.

2. After a short-term spurt in productivity growth as the economy recovers, we can expect a continued long-term drag on productivity growth as a result of the trend from manufacturing to service industry and government jobs where productivity is usually low.

3. Although we can expect business to increase its investment in plant and equipment as a result of the 7 percent Investment Tax Credit and new depreciation rules, the job of increasing productivity has become complicated by changes in the nature of the American work force. [Ref. 13: pp. 4-5]

The recession of 1974-75 aggravated an already poor productivity showing and idled large amounts of productive capacity. The concern for the lack of a consistent national policy on productivity improvement resulted in the

establishment of the National Center for Productivity in 1975. The National Center for Productivity was intended to continue the efforts of the National Commission on Productivity. Legislation establishing the National Center for Productivity provided for multi-year funding authority which the National Commission on Productivity never had. The National Center for Productivity was to identify, encourage and disseminate useful practices and techniques for enhancing productivity growth in both public and private sectors as well as functioning as a national focal point for productivity matters. A national focal point for productivity is not a new idea. Practically every industrialized country in the world has one. Some of these countries' centers were established at the request of the United States as a precondition to assistance under the Marshall Plan after World War II.

Subsequently, in the 1970's, stagflation took the world by surprise. Double digit unemployment coupled with double digit inflation prevented companies from making capital investments due to reduced cash flow and increased uncertainty. By the mid 1970's, the productivity slowdown was worsening, with the acceleration of inflation and world oil prices contributing to the problem. The 94th Congress attempted to sort out tax proposals designed to stimulate capital investment, thereby improving productivity. The 95th Congress was also amenable to tax cuts. The Acting

Director of the Office of Management and Budget (OMB), Mr. James T. McIntyre, Jr., strongly supported the budgeted $25 billion tax cut, a portion of which was directly targeted to productivity improvements. The Honorable W. Michael Blumenthal, Secretary of the Treasury, supported a 4 percent tax cut in corporate tax rates and recommended that the ITC (Investment Tax Credit) be made permanent.

In 1976, Congressional hearings were held on Tax Policy and Capital Formation by the Subcommittee on Financial Markets to analyze the effectiveness of present national policy and recommend adjustments. Congress filled an administrative gap by the Investment Policy Act of 1977. Its purpose was to enunciate a national policy on investment in the private sector of the United States economy. In 1978, the Council of Economic Advisors was still addressing the magnitude of the uncorrected productivity problems. In its annual report, the Council emphasized that the current slowdown in U.S. productivity growth is still one of the most significant problems of recent years. In its 1979 report, the Joint Economic Committee reiterated that the United States' poor productivity performance made significant contributions to stagflation and that sound, long-run government productivity improvement policies were the key to its correction.

By the 1980's, experience with productivity problems had led the Congressional Budget Office (CBO) to conclude in

a study for the House Budget Committee that government policies can affect productivity growth but that the productivity problem is so all-encompassing that government should not attempt to directly influence private decisions affecting productivity. The CBO also warned against searching for a single, all-inclusive productivity policy. The CBO recommended that productivity policies be developed for the following areas:

1. Personal Savings,
2. Capital,
3. Labor Quality,
4. Enabling Technologies,
5. Impact of Government, and
6. Energy. [Ref. 18: p. XV-XVI]

In fact, government has known of the advantages of targeting these areas for years. For example, the Investment Tax Credit was enacted in the early 1960's to promote capital investment for productivity improvements. Education, pay, and quality of working life initiatives were targeted to motivate labor and improve productivity. Selective government actions like Manufacturing Technology, increased depreciation, military specifications reviews, and the Commission on Government Paperwork attempt to promote efficient technologies and minimize the adverse impact of government on productivity improvement. Recently, the government has begun to investigate more efficient means of harnessing

energy and improving productivity. Therefore, the CBO study's main contribution was its warning against attempting to formulate a unified productivity policy.

Executive Order 12332 of 10 November 1981 maintained the high national attention in the productivity arena by establishing the National Productivity Advisory Committee (NPAC) whose purpose is to be the national focal point on matters relating to productivity. Subsequently in 1983, PL 97-367 authorized a National Conference on Productivity, to be overseen by the NPAC, with the purpose of coordinating the background, development, and recommendations on improving productivity in the United States. These recommendations are to be made by a cross section of business, labor, academic, and government individuals and organizations. Eleven policy areas are outlined in PL97-367 for the conference to consider: reorganizing the Federal Government to promote productivity improvements, promoting the benefits which result from implementing productivity improvement techniques, improving the general training and skill level of American labor, informing American businesses of foreign technology developments, sharing government research with industry, establishing awards for businesses and industries that make improvements in productivity, revising the tax laws to improve productivity, reviewing the effects of antitrust laws on productivity, reviewing our patent laws, improving the accuracy and reliability of productivity measures, and revising federal civil service laws.

These actions set the stage for a renewed emphasis on productivity in the 1980's. This revived fervor over productivity was destined to affect the DOD since DOD exercises control over the largest parcel of the government's procurement monies. Senator John Tower told the Honorable Caspar W. Weinberger during the Defense Secretary's nomination hearings in January 1981 that "these extra billions of dollars buy so few planes, ships or missiles...it (productivity) has got to have more emhasis" [Ref. 19: p. 7]. The marching orders were unmistakable; productivity is a prime issue. And the emphasis came none too soon as the seriousness of labor productivity at the time was echoed by Mr. James Stillwill, Vice-President--Quality Assistance at McDonnell-Douglas Corp., "...as much as 40 percent of the manufacturing effort is expended in doing work over or completing something that was left undone..." [Ref. 20: p. 50]. Additionally, labor productivity problems in the U.S. auto manufacturing industry are legendary. The Defense Industrial Base Panel noted that the U.S. Aerospace industry invested in new capital assets at a rate of 2 percent of sales versus a U.S. industry average of 8 percent in the last decade.

The DOD emphasis on productivity has paralleled political interest. The DOD's emphasis has been concentrated into two main areas, intra-DOD (primarily capital and labor), and industrial base (primarily capital). Perennial political interest in weapon systems costs has also maintained the DOD's interest, over the years, in productivity

as a cost reduction tool. In 1966, Senator William Proxmire chaired hearings of the Subcommittee on Federal Procurement and Regulations which scrutinized DOD cost reduction programs initiated under Secretary of Defense Robert S. McNamara. In 1968, the Manufacturing Technology Advisory Group (MTAG) was established by the DOD and included representatives from the Air Force, Army, and Navy. This was an attempt to pursue manufacturing efficiencies and/or productivity improvement on a relatively small scale.

With the withdrawal from Vietnam came reduced DOD budgets and associated problems and concerns with productivity and excess capacity. These problems made tracking any attempts at productivity improvements within the DOD difficult at best. In 1972, military sepnding was again one of the prime subjects on Capital Hill during hearings by the Subcommittee on Priorities and Economy in Government chaired by Senator William Proxmire. In these hearings, the DOD was reprimanded for inefficiencies, and DOD spending was labeled inflationary and targeted for deep cuts. In early 1976, the Investment Policy Study Group (IPSG) was formed to identify factors other than profit which motivate contractors to invest in productive and cost-efficient capital. The IPSG backed the following studies, "Profit 76" Logistics Management Institute (LMI) report 76-3, "Investment Policy for Cost Reduction" LMI report 76-9, and "Defense Industrial Base: Executive Summary" LMI report 76-2. In September

1979, the General Accounting Office (GAO) reported to Congress that "...there is no doubt that increased productivity could reduce weapons costs" [Ref. 21: p. 31]. In 1979, the GAO released a report to the Secretary of Defense emphasizing capital investment as a means to improve productivity and reduce weapons systems costs. The GAO reiterated their stand in a 1981 report entitled "Incentive Programs to Improve Productivity Through Capital Investments Can Work."

In 1977 the DOD established the Productivity Enhancement Incentive Fund (PEIF). This fund was an attempt to improve intra-DOD productivity and enabled the DOD to quickly buy and install equipment that will pay back its cost in two years or less. In this budget program it was not necessary to identify specific projects for the funds prior to budget submission. The rationale for this policy was that any productive improvements must be made more quickly than the budget process allowed. Congress terminated the program in 1978. Only upon GAO's urgings concerning its effectiveness was it reinstated in 1979.

General Alton D. Slay, USAF, Commander, Air Force Systems Command, stated to the Defense Industrial Base Panel that adequate capital is the key to productivity within the DOD industrial base. His concern for productivity was apparent when he said:

> ...as our productivity growth rate declines, U.S. industry is less competitive and our world market share declines. This declining competitiveness weakens our dollar and further increases the cost of imports, including oil and nonfuel minerals. This smaller

> market share coupled with a weakening dollar means less capital for investment in productivity enhancing technology and modern equipment to maintain our competitiveness. This, in turn, leads to an even less competitive world position. [Ref. 22: p. 445]

In 1981, the Deputy Secretary of Defense, Honorable Frank C. Carlucci, set forth the DOD Acquisition Improvement Plan. Initiative number 5 of the plan is entitled "Encourage Capital Investment to Enhance Productivity" and is indicative of the recent emphasis on the productivity of the DOD industrial base.

DOD emphasis on productivity has progressed via the establishment of the Office of Industrial Productivity, in July 1982, and is in consonance with the national thrust through the White House Conference on Productivity. The DOD controls a major portion of the federal government manpower and expenditures and therefore is in a position to provide a substantial contribution to the national concern. The DOD has many ongoing areas of initiatives that address the productivity problem. The areas of initiative are targeted within DOD and the DOD industrial base. The major initiative areas within DOD are: Productivity Enhancing Capital Investment (PECI), operational improvement/efficiency review and resource determination, work force motivation, productivity improvement integration into PPBS, and productivity measurement program. The major initiative areas for the DOD industrial base are: test of the IMIP, productivity measurement, science and technology, Manufacturing Technology, contract finance, patent, and technical data

rights policies, elimination of non-cost effective contract requirements, and quality in defense material acquisition.

4. Summary

Productivity theory and application has advanced to an indispensible level in today's society. Because productivity positively correlates to national concerns such as inflation and standard of living, the future of its role in government policy is bright. However, isolation of the causes of the decline in productivity growth and how to control productivity growth through government policy will continue to be a challenge throughout the rest of this century. The IMIP places productivity improvement as the focal point for any change in the DOD acquisition environment. Regardless of the causative factors, investment in new capital equipment will generally improve productive efficiency. This is the unique aspect of the IMIP, that it is not a specific solution to a specific problem, but a specific solution to a general problem whose causes are uncertain.

C. RISING WEAPON SYSTEMS COSTS

1. The Rising Weapons Cost Problem

Rising weapon systems costs within the DOD have held a firm position in the American political limelight for many years. Despite attempts to improve performance in the weapon systems procurement area, the complexity of acquisition and weapon systems always ensures that sufficient

incidences of fraud, waste, abuse, and oversight can be cited by political forces to indicate military waste and negligence. This constant attention results in an organizational determination by the DOD to rid itself of the rising cost stigma. The unique political and economic conditions of the 1970's and 1980's have made this effort monumental, if not impossible. The major weapon system acquisition cycle consists of mission analysis, identification of need, exploration of alternative systems, competitive demonstrations, full scale development, test and evaluation production, and deployment and operation. Each weapon system acquisition is unique; no two are identical. There are differences in time, cost, technology, management, and contracting approaches. However, regardless of the differences, the basic acquisition process above is common to all programs. Rising costs can occur in any part of the weapon systems cycle.

The 1972 Defense Authorization Report cited the examples of rising weapon systems costs that are reproduced in Table I. Table I illustrates the increases in unit costs of standard weapon systems of each era.

2. Components of the Problem

In 1971, the Secretary of the Navy announced that the Navy was considering building a new weapon system with a unit cost in excess of $1 billion, the Nimitz class nuclear aircraft carrier. This same aircraft carrier in 1983 will cost in excess of $2 billion.

TABLE I

Tanks

Weapon	Date	Unit Cost
M-3	Early 1940's	$125,000
M-48	Early 1950's	$175,000
M-60	Early 1960's	$200,000
M-60A1E2	Early 1970's	$500,000
MBT-70	Late 1970's	$900,000

Fighter Aircraft

Weapon	Date	Unit Cost
P-51	Early 1940's	$200,000
F-86	Late 1940's	$400,000
F-100C	Mid 1950's	$1,100,000
F-104C	Late 1950's	$1,600,000
F-4B	Early 1960's	$3,500,000
F-15	Mid 1970's	$9,000,000

The final cost of a weapon system is the result of a conglomeration of system requirements, management decisions, products delivered, economic considerations and hardware/capability demanded. Some generally recognized contributors to rising weapon systems costs in the Post-Korean War industrial base have been:

1. Inefficiencies in organization and acquisition procedures,
2. Inflation,

3. Increased complexity and reliability,

4. Buy-ins and overruns, and

5. DOD profit policy.

As explained in the productivity section, any inefficiency degrades productivity and therefore raises costs. Inefficiencies can result due to inadequate organizational structure and planning, inadequate cost estimating, inadequate control systems or even inadequate or nonoptimally used production capacity. The General Accounting Office in their study entitled "Impediments to Reducing the Cost of Weapons Systems" conclude:

> Even though most weapon systems are produced in limited quantities, productivity improvements could probably have a measurable effect on costs. United States industry is facing a severe decline in productivity growth. The situation is possibly more serious in the defense industry because of the lack of competition and the profit policies that do not provide incentives for capital investment. Continued experimentation and emphasis on this problem is required. [Ref. 21: p. 31]

Inflation is an accepted factor in rising weapon system costs. Rising costs of materials, labor, and overhead are passed on to the consumer (DOD). In fact, the government makes specific allowances for inflation increases in contracting via the Defense Acquisition Regulations (DAR).

Increased complexity and reliability of weapon systems is a major reason for rising costs. For example the C-141 cargo aircraft manufactured by Lockheed includes 250,000 parts and approximately 20,000 engineering blueprints. In contrast, a 1972 automobile had about 3,000

parts. The Apollo Command and Service Moduels boasted a reliability of 9700 hours Mean Time Between Failures (MTBF) while the average MTBF for cars is around 90 hours [Ref. 23, p. 23-24].

A "buy-in" refers to an intentional attempt of a contractor to secure defense work through Government contracting procedures by submitting a bid with estimated costs which the contractor has little likelihood of attaining. A buy-in philosophy takes advantage of a well-known weakness in the defense acquisition environment which makes transferring defense work away from a defaulting contractor a risky and expensive proposition. It is expensive to transfer technology due to weapon system complexity. Expenses result due to the costs incurred in physically transferring the technology, start-up of a new production line, and delaying deployment of a new weapon system. Risk is associated with complete and timely transfer of technology. Although buy-ins were fairly apparent on some famous weapon systems acquisitions such as the C-5A and the 1052 class frigate, it is virtually impossible to prevent for two reasons. First, proof of legal intent to buy-in is difficult and entails a comprehensive review of a contractor's facility, similar to a "Should-Cost" analysis which is expensive and time consuming. Second, the DOD has generally been willing to ignore cost underestimates in order to present lower projected systems costs to Congress.

The late Mr. Gordon Rule, a well-respected and legendary acquisition expert, testified on the difficulty of handling buy-ins to the Subcommittee on Priorities and Economy in Government:

> Chairman Proximire: As to the wisdom of these two methods of procurement, let me ask Mr. Rule if you would comment on the performance of the Navy in relationship to the (1052) buy-in.
>
> Mr. Rule: Senator, buy-in is a real tough nut, especially in these ship contracts. They were advertised procurements (sic). They weren't negotiated. They were straight formal advertised bids where the low man takes it. Avondale (shipyards) was low, I think. There is nothing in ASPR that says how or when you disqualify a man for a buy-in. There is really no guidance on it. Everybody talks about it a great deal as being a poor thing, and it is, but about the only way you can get at it is if somebody has guts enough to refuse to make what has to be made; namely, an affirmative determination that a contractor is responsible, if you think he is buying-in you have to make this determination before you get a contract. If a contracting officer with guts will refuse to make that determination this would surface one of these cases and see what we can do about it (sic).
>
> Chairman Proxmire: Well, then, your assertion in your report there may have been a buy-in simply goes to that fact that you can't do anything about this situation now but in the future these should be challenged where there may well be a question as to the capacity of the contractor to perform at this price?
>
> Mr. Rule: That is right. [Ref. 24: p. 1266]

A buy-in inevitably leads to costs being incurred over and above the budgeted amount, thereby contributing to rising weapon systems costs.

DOD profit policy is a well established contributor to rising costs. This cost-based profit policy results in a tendency for increased costs on the contractor's part to achieve increased profits. Supporting studies and reform attempts in this area are presented in a subsequent section.

3. Chronology of Rising Weapon Systems Costs

The development of the Army, Navy, and Air Force since World War II is a history of military organizations battling for strategic missions, recognition, support, and budget funding. The entire defense effort after that was inefficient and and disorderly. Defense strategy was left in disarray with the buildup of nuclear weapons after World War II. Each service bargained for a share of the nuclear mission, while attempting to maintain their traditional missions which were being labeled obsolete in view of projected nuclear war scenarios. This unsatisfactory situation of having nebulously defined mission roles obviously lends itself to inefficiencies, since each service was independently formulating their own threats, devising weapon systems to counter their perceived threats, and budgeting dollars for the efforts. All this continued to occur despite the National Security Act of 1947 which created a centralized control point for the military services in the Office of the Secretary of Defense (OSD) and created the Joint Chiefs of Staff (JCS) as a multi-service strategic planning agency. Although James V. Forrestal, the first Secretary of Defense, and President Eisenhower achieved many goals in organization and control of the DOD and the military services' strategic planning, there still remained a split between strategic policy and budgeting in 1960. With this split the services were free to continue their inefficient expenditure on perceived missions and threats.

By the time Robert S. McNamara took office in 1961 as Secretary of Defense, the costly areas of weapon systems duplication by the military services were rampant. Budget ceilings appeared to be the only constraint on weapon systems costs and even then did not guarantee sensible allocation. McNamara implemented the Planning, Programming, and Budgeting System (PPBS) to bridge the planning and budgeting gap, and he established sound cost analyses to improve budget projections.

Robert S. McNamara made significant strides in consolidating and streamlining the defense organization and operation. He established the DOD Cost Reduction Program which concentrated efforts in three policy areas, buying only what we need, buying at the lowest sound price, and reducing operating costs. Through these efforts a basic management system was put in place which could provide control of national defense strategy, subsequent program budgets and budget projections by statistical analysis versus "gut feelings."

McNamara also attacked the problems of gold-plating and acquisition procedures. His efforts to reduce gold-plating are exemplified by his substitution of a $2 molded plastic turbine wheel for a $175 stainless steel one used in a generator of a nuclear weapon system. This approach to cost reduction became officially implemented as a DOD program in 1963 called "Value Engineering." Value Engineering involves functional analysis of items and, then, engineering

item performance to achieve the function at the lowest overall cost consistent with performance, reliability, quality, and maintainability requirements. The DOD Value Engineering program is defined for applications within DOD as well as for defense industrial base contractors. The motivator for contractors to participate in the Value Engineering program is a share in the realized savings. Savings of over $7 billion have been attributed to Value Engineering efforts since its official inception.

The vast growth in weapon systems complexity since the 1950's resulted in an undesirable increase in the use of noncompetitive Cost Plus Fixed Fee (CPFF) contracts since parameters (and hence costs) are hard to define in the contract definition cycle. CPFF contracts are recognized as a disincentive for contractor economy because they guarantee a specific profit to the contractor yet deemphasize the contractor's planning, cost analysis and control, and budgeting accountability. McNamara's ultimate goal was to reduce CPFF contracts from over 25 percent of total contract awards to 12.3 percent by 1965. Competitive procurement was targeted to be increased to 40 percent of all contracts awarded in 1965 from about 36 percent in Fiscal Year 1962.

Due to these apparent achievements in organization and cost reduction, the DOD found itself in good standing in 1966 hearings before the Subcommittee on Federal Procurement and Regulation of the Joint Economic Committee. These

hearings were chaired by Senator Paul H. Douglas and scrutinized the DOD Cost Reduction Program. However, the cost-conscious reputation which the DOD enjoyed was even then being undone. In response to questioning on Total Package Procurement (TPP) from Representative Thomas B. Curtis, the Honorable Robert S. McNamara stated:

> One of the most encouraging developments in this area of increasing competition in our procurement during the last year has been the evolution of the 'Total Package' contracting concept which we have recently applied to the C-5A transport aircraft program...In my judgement, the C-5A award represents a major breakthrough in contracting techniques...I think it was probably the largest single development and production contract ever awarded at one time. [Ref. 24: pp. 18-19]

Although Executive and Legislative branches were implicated in pressuring the C-5A contract award to Lockheed instead of Boeing (who was judged by contract review authorities as being best qualified), blame for subsequent weapon systems costs overruns, the largest in history, were laid squarely upon DOD shoulders.

In 1967, the first "Should-Cost" review was performed by the Navy at the direction of the Secretary of Defense. The Defense Acquisition Regulations (DAR) define "Should-Cost" as:

> ...a concept of contract pricing that employs an integrated team of Government procurement, contract administration, audit, and engineering representatives to conduct a coordinated, in-depth cost analysis at the contractor's plant. The purpose is (1) to identify uneconomical or inefficient practices in the contractor's management and operations and to quantify the findings in terms of their impact on cost, and (2) to develop a realistic price objective which reflects reasonably achievable economies and efficiencies.
> [Ref. 25: Section I, Para. 337.2]

This first "Should-Cost" effort was accomplished by a team of 43 Government engineers; auditors; contract administrators; and cost, price, and management analysts. The effort took 3 months, cost about $300,000 and savings claimed were about $100 million. The GAO attributes the demise of the "Should-Cost" approach to lack of time and availability of technically skilled personnel to accomplish it effectively, despite the apparent cost-effectiveness of the program.

By 1969, rising weapon systems costs were becoming a major problem for DOD. With the scrutiny accompanying the C-5A disaster, all major defense programs were reviewed and numerous time and cost overruns were brought to light.

Political interest in defense contractor profits, as one aspect of rising weapon systems costs, was growing. This interest sparked studies by the General Accounting Office (GAO) and the Logistics Management Institute (LMI) and peaked in 1971 with congressional hearings on the subject. The thrust of the hearings were well summarized by Chairman William Proxmire:

> It seems to me that there can no longer be a question of whether or not profits on defense contracts are too high. In many cases--not all cases, but in many cases--defense profits are too high. The report of the General Accounting Office and the testimony of individuals such as Admiral Rickover make that point crystal clear. [Ref. 26: p. 92]

The DOD recognized that the cost estimation procedures for weapon systems established under McNamara left much to be desired and it took several actions. First, in

May 1969, Secretary of Defense Melvin Laird and Deputy Secretary of Defense David Fackard established the Defense System Acquisition Review Council (DSARC) within OSD to advise the Secretary of Defense on the status and readiness of each major defense system to proceed from one program phase to the next in its life cycle and other selected programs.

Secondly, the Deputy Director of Research and Development was requested to conduct a management review at least once on each major acquisition program. The Deputy Secretary of Defense then promulgated policy on cost growth stating:

> Cost Growth is the net change of an estimated or actual amount from a base figure previously established...The events causing 'cost growth' must then be identified by one or more of the following categories and the appropriate amount of each shown as 'estimated' or 'actual.' These categories do not necessarily determine whether the cost growth could have been avoided by the government or contractor or both. They provide the essential visibility and information required to determine the cause of the cost growth. [Ref. 27: p. 1]

The policy statement continued by defining nine categories of cost growth changes to be recognized and quantified in cost growth reports. These categories are: engineering, quantity, support, schedule, unpredictable, economic, estimating, contract performance incentives, and contract cost overrun (underrun) changes.

Thirdly, in 1970, the Fitzhugh Commission highly recommended the fly-before-buy procurement policy for major weapon systems procurement. The Commission was established

by the President to probe into the procurement problems and wasteful practices of the DOD. This recommended policy conformed well to Secretary of Defense Melvin Laird's new policy of full-scale prototyping. Full-scale prototyping was the successor to the ill-fated TPP concept.

Fourthly, in 1971, the DOD implemented the "design to cost" concept which entailed designing weapons with emphasis on what was affordable. The concept was implemented sparingly and, although useful, did not appear to have produced a measurable impact in controlling weapon systems costs due to the difficulty in establishing weapon systems capabilities, objectives, and associated costs.

Finally, the Secretary of Defense sent a memo, dated 25 January 1972, to the Secretaries of the Military Departments regarding cost estimating for Major Defense Systems. The memo officially established the DOD Cost Analysis Improvement Group (CAIG) whose mission was to provide the DSARC with independent evaluative capability on major defense system programs. This action gave DOD the in-house capability to analyze weapon systems cost information submitted by the services in the PPBS process.

These actions were being taken in the shadow of the Commission on Government Procurement, which was a bipartisan commission established by PL 91-129 in 1970 and composed of 12 members. Its charter was to recommend a reform package which would help prevent the uncontrolled growth in

weapon systems costs. The Commission's report was submitted to Congress on 31 December 1972 and contained one hundred forty-nine recommendations in twelve areas which called for more highlighting of key organizational decisions, better organizational role definition, and more program visibility to Congress. Subsequent hearings before the Subcommittee on Federal Spending Practices, Efficiency, and Open Government of the Committee on Government Operations in June and July of 1975 reviewed these recommendations for feasibility prior to implementation.

The Cost Accounting Standards Board was established in 1970 to bring uniformity and consistency to accounting for weapon systems costs by contractors. Its effect in controlling rising weapon systems costs is uncertain. However, the Cost Accouting Standards certainly provided an organized framework from which to view the rising costs.

In May and June of 1972 the Subcommittee on Priorities and Economy in Government of the Joint Economic Committee held hearings on National Priorities. The general consensus of the hearings was that military spending is inflationary and should be cut.

In March 1973, The Defense Science Board released a report by the Task Force on Reducing Cost of Defense Systems Acquisition "Design to Cost, Commercial Practice vs. DOD Practice." The report found that in the commercial sector, there are incentives for cost reduction, but DOD's cost based

profit policy did not encourage cost reduction and therefore contributed to rising weapon systems costs.

In June 1973, DOD Directive 5000.4 provided a permanent charter for, and assigned the CAIG as, an advisory body to the DSARC on matters relating to program cost and as a focal point for the DOD staff and component cost analysts activities.

The Fitzhugh Commission Report identified specific reform actions. However, there was little support for the report due to serious attacks upon its validity. The Subcommittee on Federal Spending Practices, Efficiency and Open Government, chaired by a fiery Senator Lawton Chiles, refused to let the Commission report die and pushed through a bill to establish the Office of Federal Procurement Policy (OFPP) to provide a permanent vehicle for change.

By May 1975, continued weapon systems cost growth prompted DOD Directive 5000.28 "Design to Cost." The intention was to reemphasize costs by establishing cost as a parameter equal in importance with technical programs and schedules throughout design, development, and production. Additionally DOD Directive 5000.28 identified cost elements as goals for program managers and contractors. This resurgence of the "Design to Cost" concept and the emphasis on cost as a weapon system program parameter has made "Design to Cost" an integral part of the weapon systems acquisition procedures. Initiative number 22 of the DOD Acquisition

Improvement Plan (AIP), "Provide more appropriate Design to Cost Goals," is an initiative to install design trade-off studies as the basis for payment of award fees. Previously, award fees were paid prior to establishment of actual unit production cost. Initiative number 22 seeks to tie award fee payment to the actual production costs achieved.

In April 1976, OMB Circular A-109 entitled "Major Systems Acquisition" promulgated criteria and special management reporting instructions for major systems. A major defense program was defined as one in which estimated costs for RDT&E and procurement on the program exceeded $100 million and/or $500 million respectively. These parameters were raised to $200 million and $1 billion respectively.

This proliferation of reactive remedies to specific procurement system deficiencies prompted Dr. Richard D. Delauer, Chairman of the Acquisition Cycle Task Force of the Defense Science Board to state:

> The progression of acquisition policy changes from Total Package Procurement through the DSARC process, fly-before-buy, full-scale prototyping, increased emphasis on operational test and evaluation, and up to the current OMB Circular A-109 policy, has evolved out of the perceived need to correct the deficiencies observed in specific programs by introducing additional management review and decision procedural checkpoints to assure that past mistakes would not be repeated. These procedural changes have become institutionalized and have ben applied inflexibly to all programs with the result that the acquisition process has steadily lengthened and the procurement of defense systems has become increasingly costly.
>
> Lack of realism in estimation of program costs, changes in specified performance requirements, inflation, and other such causes of "cost growth" have

> caused the aggregate cost of planned production programs to substantially exceed the allocated budgetary resources, resulting in the need to delay the completion of the production phase of programs in order to fit the total available defense budget in each fiscal year. The "bow wave" effect created by too many programs in full scale development at any given time in relation to the available production funds results in an acquisition cycle for the typical defense system which is an excess of the optimum length of time and is more costly than planned or estimated. [Ref. 28: p. 1]

Considering the program instability inherent in government weapon systems contracts, a major concern was for defense contractor's long term facilities investment protection. Investment protection provides an arrangement whereby the government reimburses the contractor for fixed capital assets procured for the contract in event of premature termination or significant reductions in buys. Although this has been available to contractors for years, recent changes by DOD have increased the use of this valuable contracting tool. In 1977, the DOD promulgated policy guidelines and methods to protect both government and contractor interests. Additionally, under the IMIP, nonseverable capital assets are being included in the termination protection. This action was taken to stimulate contractor investment in cost efficient capital assets for the purpose of reducing weapon systems costs.

By 1979, the General Accounting Office (GAO) had issued a report entitled "Impediments to Reducing the Cost of Weapons Systems" in which they presented the major drivers for rising weapons systems costs as attempts to deploy systems

with new technology and high performance, low rates of production due to budget constraints and desires to maintain active production bases as long as possible, absence of price competition between contractors, lack of real motivation on the part of contractors to reduce costs, the impact of socioeconomic programs, Government controls and red tape, and a nationwide problem of reduced research and development expenditures and lessening productivity.

The GAO recognized major DOD efforts to reduce costs such as design to cost, value engineering, Manufacturing Technology, Should-Cost analyses and revised profit policies, but emphasized that these programs do not address the principle factors which were driving costs upward. The GAO found that the desire for high technology and budget constraints which lead to uneconomical procurement and production practices were the two principle cost drivers. The GAO recommended that Congress examine lower cost options before approving new weapons programs, explore with senior military officials the advantages of larger quantities of alternative weapons versus smaller numbers of high-technology systems (High-Low Mix concept), consider multi-year funding in order to take advantage of economical production practices, and take the initiative to respond to recommendations of the Commission on Government Procurement. The GAO further recommended that the Secretary of Defense complete a study to identify aspects of contract administration to be eliminated

or reduced to lower costs, and take stronger initiatives to implement policies in OMB Circular A-109.

In 1981, the Deputy Secretary of Defense, the Honorable Frank C. Carlucci, promulgated a series of initiatives collectively known as the DOD Acquisition Improvement Plan (AIP). The AIP action was undertaken at the specific instruction of the Defense Industrial Base Panel of the House Committee on Armed Services. The AIP's purpose is to further refine the acquisition process with a primary objective of reducing costs associated with weapon systems acquisition administration and hardware. The four objective areas targeted by the AIP are reduce acquisition cost, shorten acquisition time, improve weapons support and readiness, and improve the DSARC process. The AIP charts major improvements in every aspect of the PPBS and is the most comprehensive DOD management reform plan undertaken since the McNamara era.

The Honorable Mr. Carlucci demonstrated his determination to ensure effectiveness of AIP implementation by appointing the Deputy UnderSecretary of Defense (Acquisition Management) to head the Task Force on Acquisition Improvement. The Task Force was chartered 17 November 1981 to evaluate progress on each of the AIP's actions, identify barriers to implementation and to recommend corrective action to OSD for problem areas.

In December 1981, the Honorable Caspar W. Weinberger asserted that the DOD will "...demonstrate to the American

taxpayer that we can and will manage our large, complex, and critically needed defense establishment in a prudent and business-like manner" [Ref. 29: p. 10]. This statement by the Secretary of Defense illustrates the intensity with which the latest reform movement is being implemented.

4. Summary

Amid the myriad of attempts to control weapon systems costs, it is difficult to say whether costs have truly been brought under control. The cost overruns of the late 1960's and early 1970's appear to have subsided. However, inflation has very recently subsided also. The DOD has instituted programs to budget to cost and stricter organizational channels for managing weapon systems acquisition have been implemented. Perhaps the last two decades of reform attempts only now are beginning to take root in the massive acquisition bureaucracy. The warning of Dr. John S. Foster, Director of Defense Research and Engineering, is clear, unless the Government and the defense industry change the way they are doing business "...the things (industry) sells and (the Government) wants to buy will grow too expensive to provide an adequate national defense under limited funding" [Ref. 30: p. 77].

D. THE DEFENSE INDUSTRIAL BASE

1. United States--Industrial Base Relationships

The industrial base of the United States consists of the aggregate of manufacturing or technically productive

enterprises contributing to the U.S. economy. The government-industry relationship can be viewed as consisting of actions and reactions to stimuli on both sides as well as to uncontrollable economic considerations. The government uses monetary, fiscal, and legislative policy to stimulate the industrial base.

2. Economic Theory

In general, the economic theory of competitive markets will predict the size, structure, composition, and health of the industrial base. Competition is the means by which the vitality of the industrial base is maintained; enterprises with inefficient production or obsolete products are forced out of operation by businesses with new products or lower costs.

Theoretically, the Defense Industrial Base (DIB) is maintained in the same manner. However, due to the government's relationship to the DIB and its unique requirements and considerations, the DIB's vitality becomes largely a product of the government's policies on taxes, DOD profit policy, and acquisition policy. The government attempts to maintain arms-length transactions when dealing with the DIB. However, the government's socioeconomic and administrative requirements frequently make this difficult. These requirements cover safety, environmental, health, energy, equal opportunity, and other areas. For example, government allows small and minority business considerations to override

cost. In determining whether a contractor is "responsible," it may take hundreds of government employees to examine the organizational structure and operations. In major systems acquisition, political considerations can override all others in determining which sections of the industrial base will benefit from the DOD requirements. Appendix 2 is reproduced from "The Defense Industry" to illustrate differences between the defense market and a free market.

3. DIB Definition

The DIB can be defined as "...those companies that supply the military needs of the peacetime armed services" [Ref. 31: p. 1]. It can be viewed as consisting of two basic groups of contractors; defense-oriented and non-defense-oriented. Defense-oriented contractors are those who derive a majority of their sales from defense contracts. Non-defense-oriented contractors are those who derive a majority of their sales from commercial contracts.

4. DIB Background

During the early 1940's, the war effort kept employment acceptable, sufficient capital resources were available and flowing into the industrial base, and the responsiveness of the DIB to changing military needs was good due to the resources available and the simplicity of the product lines. It is difficult to conceptualize the immense operations of the DIB. In 1943 alone, the U.S. Navy took possession of 1700 ships and 14000 warplanes. These statistics represented only two weapon systems for one service.

After the war, the DIB diversified rapidly to support the peacetime national needs. The DIB surged again during the Korean War and it began to present a new face to the political mainstream. Expenditures grew from $13 to $50 billion during the period 1950-54 to finance the war. President Eisenhower coined the term "Military-Industrial Complex" (MIC) to describe a new order of society which had evolved since 1945. MIC theorists believe that:

> ...prlonged international conflict since 1945 has produced high levels of military expenditures which have created powerful domestic groups who require a cold war ideology in order to guard their power and prestige within the state's political and economic structure. These groups occupy powerful positions within the state; they are mutually supportive, and, on defense-related matters, their influence exceeds that of any existing countervailing coalitions or interests. [Ref. 32: p. 5]

The ability of the armed forces to exercise control over the political spectrum has long concerned policy makers. In fact, it is the primary reason that the military was subordinated to civilian control in the Constitution of the U.S. MIC theory espouses that military and industry have a direct hand in formulating policy and direct access to resources with which to take essentially independent actions.

5. DIB Health

Although empirical studies indicate the relationships through which government and the DIB interact, they do not describe the exact condition of the DIB. However, the state of the DIB has historically been directly correlated with the level of expenditures in the defense sector. The decline

in military expenditures which followed every military buildup (WW II, Korea, and Vietnam) inevitably induce criticisms regarding the weakening ability of the armed forces to deter aggression and carry out their other missions. During peace and wartime it is difficult to determine the exact amount of defense to fund. It is no great surprise, then, that the latest surge in interest for the welfare of the DIB occurred simultaneously with the reduction of military spending after the Vietnam conflict.

6. The Declining DIB Problem

The difficulty of attacking DIB problems is in identifying the exact nature of the problem. Lately, concerns for the state of the industrial base have cited the sharply increased delivery times sparked by increased defense procurements to support their claim. However, increased weapon systems complexity alone could account for this phenomenon. This "erosion" was based upon single procurement problems such as the M60A1 tank turret in 1973. Mr. Harold E. Bertrand of the LMI explains this problem succinctly:

> To industry, from which the army had been procuring approximately 360 sets of tank castings annually, it was simply sound business to convert excess foundry capacity to other uses or to divest itself of the unused facilities. [Ref. 31: p. 1]

The harsh economic environment combined with the productivity problems have exacerbated the DIB situation.

Mr. Bertrand points out that the industrial base is in a constant state of flux, reacting to stimulus from the

government and the commercial sectors in various fashions. If industrial base behavior is not considered in planning and budgeting, then it will be impossible to extract the most efficiency from the DIB. The thrust of government initiatives in the 1970's and 1980's has been to place government in a more responsible role in industrial base considerations.

7. DIB Chronology

It is generally assumed that the industrial base has declined over and above that caused by decreasing defense expenditures due to the incentives in the DOD profit policy. A study by the LMI explained this paradox:

> The acquisition of facilities that increase efficiency may affect the ability to obtain a contract. Under the present rules, however, if a contractor can get the business without additional facilities investment, he can expect more dollars, and a higher percentage of profit on invested capital by refraining from investment as much as possible and allowing or causing expected costs to be as high as will be acceptable. Many defense contractors are aware of this paradox and have told us that they consequently avoid facility investments whenever possible.
>
> Percentages of profit on net book value of plant and operating capital (equity plus debt less facilities and outside investments) should be included in the weighted guidelines for determining profit objectives. The present percentages on labor, material and overhead costs and the percentages to be applied to the capital elements should be adjusted as necessary to accomplish overall DOD profit objective policies. [Ref. 33: p. 10]

Additonally, a Rand Corporation study in 1968 agreed that the "...U.S. discriminates against capital intensive firms" [Ref. 15: p. 45]

A special subcommittee was established in December 1967 by the Armed Services Procurement Regulations (ASPR) Committee to consider the LMI recommendation. The ASPR Committee was part of the Office of the Assistance Secretary of Defense (Installations & Logistics) and was responsible for developing any needed amendments of ASPR. The special subcommittee was given the specific task to develop and test procedures for giving greater weight in prenegotiation profit objectives to capital employed, evaluate the results of the test, and if appropriate, recommend any needed changes to the ASPR Committee.

The subcommittee issued a report dated 15 March 1968 presenting a test plan and procedures for developing information on Contractor Capital Employed (CCE) in contract performance. After further study, in October 1968, the proposal was presented to a panel of the Defense Industry Advisory Council which was chartered to explore ways and means to foster and maintain a healthy defense industrial base. (The Defense Industry Advisory Council was established in 1962 to provide a means for direct and regular contact between the Secretary of Defense and his management assistants and knowledgeable industry representatives.)

Subsequently, in June 1969, the Defense Industry Advisory Council recommended to the Secretary of Defense that in addition to other costs, DOD profit policy should recognize and provide for adequate return on company capital

employed. A new ASPR subcommittee was established in October 1970 which distributed for comment draft forms for gathering preliminary data on Contractor Capital Employed. In 1972, DOD profit policy was officially revised to Contractor Capital Employed (CCE) policy. Profit was based on contractor input to total performance (CITF) and 50 percent on risk and capital investment. Capital investment percentage of profit depended on contract type and amount of risk associated with it and was found by using these parameters in a table lookup format. The CCE profit policy was not implemented on a firm basis and was never fully subscribed to by the DOD. Therefore the objective of motivating contractors to invest in capital equipment was not achieved.

In March 1972, DOD profit policy and its limitations were presented by Mr. Henry M. Paulson, Jr., Staff Assistant, Office of the Assistant Secretary of Defense:

> The two basic objectives of the DOD profit on capital policy are
>
> 1. To attract adequate capital to assure an efficient and responsive industrial base for national security.
>
> 2. To reduce the overall cost of weapons by providing incentives for industry to invest in modern efficient equipment and facilities.
>
> There are a number of problems with our present cost-based profit policy which have been emphasized in various studies and the recent GAO defense industry profit study. Firstly, the current profit policy fails to provide positive incentives for contractors to invest in efficient cost reducing facilities. This argument goes as follows: prior to negotiation, the contractor target profit varies directly with the cost estimate. As the cost estimate goes up, so does the profit and conversely, as the cost estimate goes down, the profit

> goes down also...it is safe to say that the current profit policy frequently provides only a penalty for a capital investment when it should be providing a reward.
>
> Another weakness of our cost-based profit policy is that it results in inequities in profit on capital opportunity among contractors with different capital requirements. Simply by failing to consider capital the DOD can place itself in the embarassing position of having profits negotiated on two different contracts which are equal when measured as a percentage of cost but grossly unequal when measured as a percentage on capital because the contracts have different capital requirements. [Ref. 34: p. 1]

This concept led to successive changes in DOD profit policy to improve the basic incentives. These changes are discussed in the next section.

Due to the severe economic climate in the 1970's, additional incentives were needed to encourage contractor investment in upgraded capital equipment. The ITC, taxes, and other tangential policies to provide incentives for capital investments and maintenance of the industrial base were examined.

In 1975, the Honorable W.P. Clements, Deputy Secretary of Defense, initiated the "Profit 76" study which would, by examination of DOD profit policy, provide recommendations to encourage industry investment in capital equipment. At the same time, concerns about an impending capital shortage were becoming widespread. The concern was that, in the current recession, government borrowing may crowd out a substantial volume of private sector borrowing. This would further inhibit capital improvements in industry. An extensive examination of investment requirements and savings flow at

the time was conducted by Dusenberry and Bosworth. This study concluded that a capital shortage can be barely avoided [Ref. 43: p. 5].

In June and July of 1975 the House Ways and Means Committee held hearings on tax reform. The recurring recommendations at the hearings were to shorten the period of capital cost recovery, increase the ITC, reduce capital gains tax, and eliminate double taxation of corporate income by making dividends deductible.

On 1 July 1975 Cost Accounting Standard 409, "Depreciation of Tangible Capital Equipment," became effective. Contrary to the direction of policy making at that time, it was believed that CAS 409 would reduce profits on defense contracts since it forced the contractor to depreciate capital assets on defense contracts in a manner which must "...reflect the pattern of consumption of services over the life of the asset" [Ref. 35: Sec. 409.40(a)(3)]. This effectively disallowed defense contractors from using accelerated depreciation methods and charging the higher expense to government contracts. The move was consistent, however, with the Cost Accounting Standard Board's (CASB) charter to provide uniformity and consistency in accounting for defense contracts.

In 1976, Defense Procurement Circular (DPC) 76-3 promulgated new DOD policy as a result of the "Profit 76" study. It implemented CAS 414, "Cost of Money as an Element of the Cost of Facilities Capital," and established a weighted guideline for facilities investment at six to ten percent

of the contract fee. The DOD initially objected to this increase in profits under CAS 414, which allowed interest expense on capital employed, and they revised their profits down to negate its effect. Additionally, under DPC 76-3, the weight of contractor performance was reduced from 65 percent to 50 percent, cost risk weight was increased to 40 percent from 30 percent, and several other factors were eliminated. Subsequently, Defense Acquisition Circular (DAC) 76-11 revised the DAR to include sections 1-213, "Capital Investment by Contractors," and section 3-815 which dealt with capital investment special termination buyback provisions. Defense Acquisition Circular (DAC) 76-23 increased facilities investment Weighted Guideline (WGL) to sixteen to twenty percent. This increase was programmed at the outset of the facilities investment WGL concept to follow an administrative period of implementation and was strongly supported by the GAO. DAC 76-23 established a separate profit weight for research and development, and service contracts. It also eliminated the DOD's practice of negotiating profit downward to negate the effects of CAS 414 cash flow.

In 1977, the concern for the DIB broadened beyond profit policy to include government procurement practices as a whole. Mr. Jacques Gansler, Vice-President of the Analytic Sciences Corporation, in hearings before the Joint Committee on Defense Production in the United States, stated:

> Thus in many important areas, the effect has been that those few remaining suppliers are in a monopolistic position, and thereby able to rapidly raise prices, and to dictate delivery times. These price increases should, by traditional economic theory, result in large numbers of companies rushing to enter this market. Price increases of 300 to 500 percent in one year have been observed.
>
> However, no such 'rush' has been found. It is hypothesized that this is attributable to the 'Barriers to Entry' that the DOD has created through its procurement practices--that is, military specifications; preferred parts' lists; small quantities; annual procurements; and low profit. [Ref. 36: p. 62]

In 1978, the government reduced the maximum capital gains tax to increase industrial base profits with the intention of encouraging capital reinvestment.

Subsequently, the GAO found in a 1979 study that the new DOD policy initiated under DPC 76-3 resulted in higher profits negotiated with some contractors without any demonstrable reduction in costs to the government. The GAO found little indication that contractors had responded positively to DOD's attempts to encourage greater investments in new or upgraded plant and equipment which would have lowered production costs.

The GAO attributed this lack of success primarily to the limited emphasis given to facilities investments in establishing the government's prenegotiation profit objectives.

The GAO found that, although the new profit policy had not encouraged contractors to increase their investments in cost-reducing facilities, it had resulted in the negotiation of higher profit rates on an overall basis. This

was contrary to DOD's intent at the time [Ref. 37: pp. 1-18].

In 1980, a report entitled "Payoff 80" was completed by Headquarters, Air Force Systems Command (AFSC) examining productivity, manufacturing, and other industrial base issues critical to the long term economic and military strength of the United States. This Task Force formally endorsed the Air Force's "Technology Modernization" concept, which was initiated in the F-16 program contract. "Tech Mod" was to become the spark and framework for the IMIP.

In July 1980, the House Armed Services Committee (HASC) held hearings entitled "Capability of the United States Industrial Base." The HASC was presented with the problems of declining productivity and the shrinking industrial base. The major contributors to the declining industrial base were cited as inflation, tax policy, productivity decline, and DOD profit policy. Inflation was recognized as a semi-controllable factor which would be dealt with over a period of years with monetary and fiscal policy. Capital investment appeared to be a logical solution to upgrade the industrial base. The disincentives to investment that the contractor experienced in DOD business were:

1. depreciation periods based upon useful life,
2. unallowability of interest expense, and
3. program instability.

The disincentives to capital investment due to the useful life depreciation restriction were partially removed

by the Economic Tax Recovery Act of 1981 which allowed the following depreciation schedule for tax purposes: buildings--10 years, equipment--5 years, and vehicles--3 years.

The disincentive to investment that the contractor experienced due to unallowability of interest expense was intended to be removed under CAS 414. However, as mentioned above, the DOD objected to the profit which would be given to the contractor under this Standard and promptly reduced the profit on contracts to negate its effect until the issuance of DAC 76-23.

The major area of disincentives to be addressed was program instability. The Report of the Defense Industrial Base Panel of the Committee on Armed Services, which followed the Industrial Base Capability hearings, recommended, in part, that the HASC favorably consider legislation to establish a flexible defense procurement policy which will result in the acquisition of weapon systems and other items in the most timely economic and efficient manner, specifically authorize multi-year contracting, and make provisions for advance procurements of components, repair parts, and materials in the most effective economic lot purchases and efficient production rates.

In response to these and other recommendations, the Honorable Frank C. Carlucci, Deputy Secretary of Defense, established the DOD Acquisition Process Working Group. Their summary recommendations for economy and efficiency in

defense systems acquisition became the basis for the thirty-two Carlucci initiatives promulgated in mid-1981.

In April 1981 the GAO released a study entitled "Incentive Programs to Improve Productivity Through Capital Investments Can Work" which further spurred national attention to capital investments as a key to solving the problems of productivity, costs, and the stat of the industrial base.

In May 1981 the DOD Task Force to improve Industrial Responsiveness (TFIRE) was formed by Dr. Richard Delauer, Under Secretary of Defense for Research and Engineering, to examine the broader aspects of industrial preparedness including national planning, availability and stockpiles of critical materials, and long-term mobilization. The TFIRE team recommended twelve actions addressing improvement in the areas of defense, industrial preparedness, and national base of resources, skilled labor, and productivity. These actions were referred to as the DOD Industrial Responsiveness Improvement Program.

In December 1981, the DOD Authorization Act of 1982 was passed and included PL 97-86 which repealed the Vinson-Trammel Act governing profit limitations in shipbuilding.

In his annual posture statement to Congress, Secretary of Defense Weinberger summarized the major problems and challenges of the industrial base:

> Productivity in Defense supporting industries is too low. Compared to other business, Defense contracting is viewed by business as less stable, less predictable, and thus less attractive than commercial business. [Ref. 38: p. 191]

Following the address, Dr. Richard Delauer established a tri-service committee, chaired by the U.S. Navy, to prepare a unified DOD policy on Technology Modernization. Also, the Deputy Secretary of Defense issued an industrial preparedness policy statement which directed a new policy of "weaving" industrial base considerations into the acquisition process and demonstrating to industry that industrial preparedness is an integral part of acquisition. Specifically, the actions contained in the DOD Acquisition Improvement Program and eight actions of the DOD Industrial Responsiveness Improvement Program constitute DOD's effort to "weave" industrial base considerations into the acquisition process.

8. Summary

The maturing of the DOD-industrial base relationship has been a difficult and painful process. The DOD has realized that contractors cannot be expected to fully assume the risks inherent in today's acquisition environment. The scarcity of resources and growing technological costs associated with defense acquisitions makes motivation and efficiency vitally important in the return we get for our defense dollars.

V. IMIP ASSESSMENT

A. GOALS OF THE IMIP

The IMIP is based on the theory that improved productivity in the DIB can be obtained by the application of capital and technology to the manufacturing process. Under the auspices of the IMIP, contractors are to be motivated to make productivity enhancing upgrades to plant and equipment by the elimination of disincentives to investment and the addition of incentives to make capital improvements. Two of the disincentives to investment are identified as the policy of pricing contracts on the basis of costs expected to be incurred and the application of DAR 3-815 to severable plant equipment only. Incentives identified are shared productivity rewards and contractor investment termination protection.

The primary benefit projected under the IMIP is improved productivity in the DIB. This improved productivity is expected to yield more efficient and economical production of quality end items; improved responsiveness from contractors, subcontractors, and vendors; and a reduction in acquisition and life-cycle cost of defense systems. Secondary benefits anticipated under the IMIP are reduced lead times, an increase in surge and mobilization capability, improved product reliability, and manufacturing planning based on a long-term

perspective. This chapter will provide an assessment of the degree to which the IMIP may be expected to meet the goals established for it, the potential adverse effects from the Program, and provide recommendations for consideration during the test period.

It is recognized that the IMIP is in a test period, the purpose of which is to learn what works and what does not work. In that regard, all assessments are directed at the IMIP as it exists during the test, not the refined IMIP that will be developed after the test.

B. GOAL ATTAINMENT

The theory of productivity improvement through capital investment, as discussed in Chapter IV, is well substantiated in practice. Its application in the IMIP is sound and may result in improved productivity and reduced unit costs. Based on the administrative burden it places on government, it would be useful to analyze the potential scope of the IMIP. Utilizing the Air Force's F-16 Tech Mod with General Dynamics as a model, the total savings estimated (both to government and contractor) was $370 million ($220 million of which is the government's share). The capital investment by General Dynamics amounted to $150 million. The total shared savings figure is a rough estimate of the increase in production efficiency achieved by the capital investment. This figure assumes many stable parameters such as number of aircraft to be procured, procurement schedules, and performance

specifications. In terms of the productivity example in Chapter IV, this savings theoretically allows the government to buy more F-16's for the same resources or an equal number of F-16's at reduced cost due to increased productive efficiency. Due to the shared savings concept, the government is losing $150 million of the total savings to the contractor for the purpose of motivating him to implement the capital improvements.

The objective of reducing weapon systems cost must address unit cost and total acquisition cost considerations. As noted above, the unit cost of weapon systems might be reduced due to increased productive efficiency. However, total acquisition costs are not reduced by the product of units procured times unit cost savings because of shared savings. Therefore, although the effect of IMIP will be to reduce total weapon systems acquisition costs, the amount by which total costs are reduced will specifically depend upon the shared savings percentage. In the case of a contractor who negotiated a ninety percent savings share, the total acquisition cost savings could be nearly negligible.

The presentation of the declining industrial base problem in Chapter IV highlighted the fact that the decline is a result of many factors, the main factor being economic. That is, as in the case of the M60A1 tank turret castings, the industry began ridding itself of excess capacity to provide a lean business profile to the extremely harsh economic

climate of the last decade. It is unrealistic to state that the IMIP will help reduce this area of industrial base decline. The business trend is clear, the industrial base will become even leaner as businesses strive to meet competitive and economic pressures. The IMIP will certainly provide incentives for a changing defense industry to update its base, but not to the extent of maintaining excess capacity without cost to the government.

The other aspect of the declining industrial base associated with the loss of excess capacity is loss of surge capacity. Surge capacity is the ability to rapidly accelerate production with the existing DIB through the adoption of a multi-shift, extended work week utilization of existing production lines and production facilities.

The proposed charter critera of the IMIP test for program selection states "The investment should primarily support enhanced production efficiency of an existing or anticipated operation, not new production capacity" [Ref. 1: p. 3]. This "new production capacity" is defined as that increase in production capacity over and above that reasonably expected from the increased efficiency of the new capital equipment. However, the proposed instruction indicates that industry should be motivated to "Reduce lead time and increase the surge and mobilization capability of industry" [Ref. 2: p. 2].

There were no programmatic controls established during the IMIP test period to ensure that surge and mobilization

capacity are consistently improved when an IMIP is implemented. Therefore, IMIP's will, in general, not support new production capacity, and hence surge, which is in consonance with the charter criteria above. However, it should be noted that the IMIP framework may be used to fund maintenance of excess (surge) through shared savings.

There is a general impression that capital equipment which improves productive efficiency automatically provides for increased surge capacity. This view is not necessarily correct and stems from observing efficiency improvement in terms of time instead of in terms of cost. For example, two old machines might produce items at a rate of ten per hour each and a unit cost of $5. Newer machines will generally be capable of producing items faster, say fifteen per hour and with more efficiency, say at a reduced unit cost of $4. The improved capital equipment will be of the latest technology and most likely will reflect the industrial movement toward computer aided manufacturing. This capital equipment requires a much larger initial financial input and incurs greater amounts of overhead and operating costs. Consequently, companies will attempt to minimize inactive or down time of the capital equipment. This, in turn, reduces the limited amount of surge capacity existing in the defense industrial base.

In the example given above the manufacturer will tend to buy one fifteen unit per hour capacity machine to replace

the two obsolete ten unit per hour capacity machines and make up the reduced operating capacity by increased operational shifts and extended lead times. This improves his efficiency and produces a greater return per time period, but reduces his "surge" capacity.

Jacques Gansler recognized this phenomenon as major evidence of the decline in the capability of the defense industrial base:

> Also, the manufacturing equipment that would be needed for the higher production rates is far more complex to operate and the labor skills required are thus considerably greater. Finally, this manufacturing equipment is much more expensive and therefore far less likely to be sitting around unavailable (much of it is in three-shift use in peacetime). [Ref. 39: p. 125]

Recognizing that three-shift operation produces inflexible production schedules, which are impossible to surge, highlights the seriousness of this contributory factor to the declining DIB.

The other difficulty with improving surge capacity is in ensuring that a total weapon systems approach to IMIP implementation is used. A top down factory-wide implementation of an IMIP to improve surge capacity may not be very effective in the final analysis if the contractor depends on other sources for parts or if the contractor is not involved in the production of an entire weapon system. Sporadic increases in surge capacity across the defense industry spectrum may improve our overall posture in adjusting to future military surge requirements but may do nothing for immediate surge capacity requirements in the short run. For

example, in the case of the M-1 tank, Avco currently cannot produce engines fast enough to maintain equilibrium with the completed chassis. This situation certainly reduces the emphasis required to speed production (i.e., working with Avco to improve engine manufacture); however, the industrial base does not produce M-1 tanks with any greater capacity.

C. ADVANTAGES

The IMIP has two major areas of benefit which require noting. First, it breaks the bonds of the DOD to the rigid cost-based profit policy and allows greater flexibility in dealing with contractors. Secondly, the IMIP is the first government program which requires specific, measurable improvements in the industrial base.

The discussion of the government's cost-base profit policy in Chapter IV readily illustrates the need for profit policy reform and the need for flexibility in procurement. The major inherent motivation in the cost-based profit policy is to cause contractor emphasis on increased costs (or a lack of concern for costs in general) to achieve increased profits. It provides no motivation for contractor efficiency and cost reduction. The IMIP provides a refreshing vehicle by which potential cost savings achieved through capital investments can improve contractor profits and obtain contractor commitments to improve their industrial base. This ability to improve the profit picture of a contractor

for capital improvements represents an historic step away from the restrictions of the cost-based profit policy.

An additional advantage of the IMIP is that it provides more of a mandate for capital improvement by the government than the present incentives under tax policy. For years, government has attempted to stimulate the industrial base toward capital improvements through such tax policies as depreciation laws and tax credits. These tax policies have provided the industrial base with incentives to invest but did not force investment. Tax reductions for industry provide positive cash flow to "push" consideration of capital investment but do not provide any mandate to use the tax saving dollars for capital improvement. Tax credits and depreciation provide a "pull" for industrial base contractors to invest in capital equipment but again do not provide mandates. In both instances, the contractor perceives no reimbursement for lost profits on DOD contracts due to reduced costs because of the use of new capital equipment. The IMIP, on the other hand, is an agreement between the government and contractor which mandates specific capital improvements to be installed. The shared savings feature of IMIP motivates the contractor to make capital investments in specific areas of the industrial base where it is beneficial to the government.

D. POTENTIAL DISADVANTAGES

There are several areas in which it is envisioned that the IMIP might have an adverse effect. These areas are the

effect of the IMIP on competition in the acquisition process, on the Government's goal of simplifying procurement, on the acquisition workforce, and the perception that shared savings represent increased contractor profit.

1. Effect On Competition

The Government, the DOD, and the Navy are taking a strong interest in increased competition in the procurement of systems and equipment. White House interest and involvement was expressed by Executive Order 12352, "Federal Procurement Reforms" of 17 March 1982. Section 1.(d) of that order directs the heads of executive agencies engaged in the procurement of products and services from the private sector to:

> Establish criteria for enhancing effective competition and limiting noncompetitive actions... [Ref. 40: p. 1]

DOD's response to the White House directive was to take a leadership role in the implementation of the Executive Order. According to the OUSD:

> It may be of further interest that we have taken significant action under our AIP to simplify the DOD procurement process and to increase competition. [Ref. 40: p. 1]

The leadership role of the DOD and Congressional interest in increased competition was demonstrated by the establishment of the Navy's first Competition Advocate General on 12 July 1983.

> The decision to establish this new position resulted from the shared concern of Congressman Dan Daniel of Virginia and Secretary Lehman that competition in the Navy's procurement process needed to be greatly increased to reduce the cost of equipment acquired by the Navy. [Ref. 41: p. 43]

The IMIP will have to be applied in a time of increased emphasis of competition. This may prove difficult since IMIP, by making the participating contractor more efficient, does not encourage competition. Looking at the application of the IMIP under the different scenarios of a sole source and in a highly competitive environment demonstrates the problems faced.

The first scenario entails the award of a contract incorporating the IMIP on a non-competitive basis. The lack of competition could mean either that the awardee is the only contractor capable of producing the product being bought by the Government (sole source) or that there are other contractors capable of making the product, but for some reason, for example, a perception that they could not bid competitively, they did not participate in the procurement action. If in the first case, only the awardee is capable of producing the product, new contractors will be discouraged from manufacturing the product due to the improved manufacturing capability of the awardee. This barrier to entry will ensure that the sole source situation will be perpetuated. In the second case of this scenario where there are other manufacturers capable of producing the product, but they do not participate in the bidding process, the result will be the same. The existence of a modernized, more efficient awardee could dissuade other contractors from participation since they see him as more difficult to compete against.

The second scenario is the IMIP in a highly competitive environment. Under this condition, the IMIP proposal is to be used in the evaluation of the contractor's bids. This means that, in addition to the regular criteria for selection of a contractor (price, delivery time, past performance, etc.), the PCO will also evaluate the IMIP proposal as an element of the bid. This adds another complexity. If the award is to be made on the basis of price, will it be made to the contractor who proposes the lowest cost without the IMIP projected savings, or to a contractor who proposes the lowest cost based on the IMIP projected savings? In this scenario, as the first, the result is the same. The contractor selected for the award and participation in the IMIP will become more efficient and more difficult to compete with on subsequent contracts unless the losing contractors use their own funds to invest in capital improvements. An alternative proposed by some individuals involved with the IMIP test is to rotate, on a to-be-defined basis, IMIP associated awards among competing contractors. This is intended to modernize many contractors in a specific field instead of just one. However, two problems are inherent in the proposed rotation. The first is determining the basis for selection. Since the most efficient contractor with the lowest proposed cost (this assumes the benefits of the IMIP under the previous contract have been achieved) would be the one which has already participated in the IMIP, the award

could not be made on a cost basis. The Government would lose financially if the award were not made on the basis of cost and would, in fact, be subsidizing the modernization of the DIB at the taxpayers' expense. The second problem apparent with rotating awards would be that it might actually result in lower overall capital investments within the DIB. Contractors, rather than investing their own funds for capital improvements in out years (not participating in the IMIP), would wait for their turn in the rotation and access to the IMIP funding.

The two scenarios show that the IMIP is not necessarily counter-competitive, but that applying it in a manner that enhances competition will be difficult.

2. Effect on Acquisition Simplification

The Government has clearly defined its goal of simplifying the procurement process. This objective is demonstrated by Section 1.(a) and 2. of Executive Order 12352, "Federal Procurement Reforms."

> Section 1.(a) Establish programs to reduce administrative costs and other burdens which the procurement function imposes on the Federal Government and the private sector. Each program shall take into account the need to eliminate unnecessary agency procurement regulations, paperwork, reporting requirements, solicitation provisions, contract clauses, certifications, and other administrative procedures... and
>
> Section 2. The Secretary of Defense, the Administrator of General Services Administration (GSA), and the Administrator for the National Aeronautics and Space Administration (NASA) shall continue their joint efforts to consolidate their common procurement regulations into a single simplified Federal Acquisition Regulation (FAR) by the end of calendar year 1982. [Ref. 40: p. 2]

The Government is supposed to simplify the procurement process through the reduction of administrative burdens, paperwork and regulations.

The reduction of administrative burdens is currently being addressed by Task Group Four of the six interagency task groups formed to develop policy guidance under the combined leadership of the Office of Management and Budget (OMB) and the Office of Federal Procurement Policy (OFPP). The reduction and simplification of acquisition regulations was led by the OFPP through the publication of the FAR on 19 September 1983. The FAR, which will become effective on 1 April 1984, represents a major consolidation and restructuring of the DAR, the Federal Procurement Regulations (FPR) and NASA Procurement Regulations. It is thus apparent that the present intent of the Government is to simplify the procurement process.

This is the environment into which the multi-phase IMIP with its requirements for procurement regulation changes, in-depth technical and financial analysis of contractors, additional solicitation provisions and contractor selection criteria, MOUs and MOAs, complex DCFs, and close monitoring of contractor performance has been thrust. Although it is not the specific intent of the IMIP to make the acquisition process more complicated, the needs of the Program definitely do so.

Additionally, the conflict between the DOD's move away from its long-standing cost-based profit policy and

the recent move to simplify the procurement process must be understood. It was the relative simplicity of the cost-based profit policy which led to its adoption. It had a universal application with little consideration for individual contractor's needs. This characteristic is the precise reason the thrust of Federal Procurement Policy has been away from the cost-based profit policy. The requirements of the Industrial Base and the Government are being met if the system is more flexible (i.e., gives more individual recognition to any one contractor than would otherwise have been the case). This flexibility expands the amount of regulations required to define the standard procurement process in each action, thus creating a more complex procurement system. Although it is possible to reduce the administrative schedules associated with major weapon systems procurement, and achieve simplification of the weapon systems acquisition process, it is relatively difficult to reduce any other aspect of the procurement process without losing accountability or control. Consideration of this viewpoint and meticulous oversight on the extent of implementation of these two policies will be required in the future.

3. Effect On The Procurement Workforce

The DOD procurement workforce is facing some crucial problems that endanger its ability to complete its mission in a satisfactory manner. Three of the major problems are:

1. A significant yearly increase in the number and dollar value of contract actions completed,

2. Increasing complexity in defense acquisition, and

3. A decline in the quality of the workforce.

The factors listed above are considered to be the major problems because further increases or decreases in them could seriously affect the mission capability of the procurement workforce.

The increase in the number and dollar value of contract actions completed is significant. In the period from FY 1975 to FY 1980, the procurement budget of the DOD increased from $46 billion to over $83 billion. During the same time frame, procurement actions of $10,000 or less (small purchase) only increased from 10,440,000 to 11,750,000, but those over $10,000 (large purchase) increased from 226,690 to 325,170.

> A very practical indication of the significance of this increase can be seen in these standard processing time allowances developed at the Defense Industrial Supply Center.
>
> Small purchase--.756 hours
> Large purchase--5.739 hours [Ref. 42: pp. 1-6]

The significance of this increase was recently partially alleviated by raising the small purchase threshold, but it is still a meaningful increase. Another crucial increase occurred in the number of procurement actions over $100,000, a category in which acquisition regulations multiply rapidly. In this area the number of procurement actions increased from 31,000 to 55,000 between FY 1975 and FY 1980, an increase of 77 percent. The DOD procurement budget has increased significantly in the past, and under the current

Administration this trend has continued. On the other hand, the procurement workforce has historically shown a growth rate of only about 1.5 percent a year.

The increasing complexity in defense acquisitions is demonstrated by the new statutory and administrative requirements that represent a series of incremental increased demands on the workforce. Some of the legislative and administrative actions demanding more skill and knowledge form the workforce in recent years are:

Public Law 95-507, an amendment to the Small Business Act which provides (i) that all purchases subject to simplified contracting procedures must be set aside for award to small business firms; and, as a condition to award of the contract, (ii) that all large business offerors on contracts in excess of $500,000 agree to submit and have evaluated plans for subcontracting a portion of the work to small disadvantaged business firms.

The Trade Agreements Act of 1979, which suspends the restrictions of the Buy American Act and the Balance of Payments program for certain products originating in certain designated countries, thus greatly increasing the potential for foreign competition and participation in the acquisition of numerous non-weapon items.

International cooperative agreements for the development and production of weapons on a continuing basis.

The adoption of goals for awards to be made pursuant to Section 8(a) of the Small Business Act. This section provides that certain contracts shall be placed with the Small Business Administration which will then subcontract the requirement to a minority-owned firm. P.L. 95-507 gave legislative status to the use of goals, a practice that had been introduced in the 1974-75 time period.

The revision and re-emphasis of OMB's Circular A-76 dealing with contracting out. This policy guide requires the preparation of work statements and cost estimates for many functions never before acquired by contract.

> The Office of Federal Procurement Policy's program for the acquisition and distribution of commercial products. This program introduces an element of uncertainty as to the adequacy of a product to meet a given requirement which must be compensated for by appropriate contractual protections. [Ref. 42: pp. 1-8]

The quality or skill levels of DOD contract specialists in the workforce is generally measured by length of service. Two other measurement methods are the separation rate of personnel classified in the Office of Personnel Management (OPM) occupational series GS-1102 entitled "Contract and Procurement" and the educational attainments of newly appointed contracting officers. By all of these measurements the quality of the workforce is declining.

A decline in length of service is shown in the Defense Manpower Data Center (DMDC) Report 1M5391 of 23 March 1981. According to the Report, the average years of service for GS-1102 series personnel declined between the years 1975 and 1981 by approximately 15 percent in the Army, 15 percent in the Navy, 3 percent in the Air Force, and 2 percent in the DLA. An increase of personnel in the GS-1102 series during the same period from approximately 12,000 to 14,000 partially accounts for the overall DOD decrease of 8 percent in length of service, but there are numerous other factors. Of these, only the increase in separation rates will be addressed.

The increase in the separation rates for GS-1102 series is generally viewed as a factor regarding the decrease in the average years of service. According to the DMDC Report 1M5391, the separation rate for personnel in the GS-1102

series between the years 1975 and 1981 increased by 30 percent in the Army, 2 percent in the Navy, 60 percent in the Air Force, and 72 percent in the DLA. A lack of positive correlation between the decline in average years of service and the increase in the rate of separations is apparent. It could indicate that those services with the highest rates of separation, such as the DLA, are also the agencies that are able to attract experienced personnel (measured by average years of service). The bottom line is that the overall DOD rate of separation increased by 40 percent during the period with the primary cause cited as a basis for separation being the pressure resulting from a heavy workload and the ever-increasing regulations.

The final measure of quality in the DOD workforce is the educational attainment of newly appointed contracting officers. According to the General Accounting Office (GAO) this is also declining:

> Over the past two or three years, the quality of the procurement work force has been declining in both the civil and defense agencies. This is evidenced by lower educational attainments among newly appointed contracting officers, difficulties in filling agency intern programs with qualified candidates, and complaints from procurement officers about the lack of skills of new personnel.
>
> An example is provided by the Office of Personnel Management's Central Personnel Data File. It shows a 7.2 percent drop in the number of college graduates entering the Contracting Officer (1102) series...
> [Ref. 42: p. 16]

The procurement workforce is facing an increasing workload, more complex regulations, and a decline in the

quality of its personnel. Under these conditions, the IMIP cannot help but have an adverse effect on the workforce: the IMIP will not reduce the number of contracts and will actually add steps to each one (Phase I, II, and III); it brings with it an entire new set of complex regulations in the form of an instruction, a guide and DAR clauses; and it could result in a further decline in workforce quality due to the additional pressure forcing more GS-1102 personnel to separate.

4. Shared Savings Perspective

The contractor's portion of shared savings may be viewed by some concerned parties as additional profit when it exceeds the value of the contractor's capital investment. This misconception of shared savings as excessive profit rather than a reasonable ROI could have the adverse effect of eroding some support for the IMIP in parties concerned with cost reductions.

5. Summary

It is thus apparent that potential adverse effects of the IMIP are significant: in an era of increased emphasis on competition, it will be difficult to operate the Program to enhance competition and it might actually be counter-productive; it will bring increased complexity to the acquisition process at a time when a major effort is underway to make the process simpler; it represents added regulations, analysis, and procurement steps for an already overtaxed

acquisition workforce; and its shared savings concept might be viewed as excessive profits for contractors.

E. RECOMMENDATIONS

This paper has presented an analysis of the IMIP and a review of its historical elements. Based on that analysis, the following recommendations are presented:

1. To continue the test for a reasonable period of time with the goal of reaching a joint consensus of the final forms for the IMIP regulations and DAR changes.
2. To issue a policy statement or establish an authority to ensure that there is a minimum of conflict between the IMIP and increased competition.
3. To determine, prior to committing the DOD to the full-scale Program, the capability of the acquisition workforce to absorb an increase in its workload.
4. To officially recognize the fact that the IMIP is a small scale exception to the acquisition simplification program.
5. To clarify and emphasize the fact that shared savings do not represent increased contractor profit.

Contractor Internal R.O.I.: 20%

IMIP SHARED SAVINGS COMPUTATION
- LMI -

	Year:	0	1	2	3	4	5	6	7	8	9
1	Contractor Investment	100.00									
2	Cumulative Contractor Inv.	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
3	Direct Govern. Funding	10.00									
4	Cumulative Gov. Funding	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5	Shared Sav.		2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17
6	+ Imputed CAS 414 Interest 14%		13.22	10.99	8.26	5.93	3.99	2.43	1.26	0.49	0.10
7	+ Profit on Facilities 18%		17.00	14.13	10.63	7.63	5.13	3.13	1.63	0.63	0.13
8	+ CAS 409 Dep.		11.11	20.83	18.06	15.28	12.50	9.72	6.94	4.17	1.39
9	+ Profit on Dep. 8%		0.89	1.67	1.44	1.22	1.00	0.78	0.56	0.33	0.11
10	- Prof. on Sav. 12%		-3.60	-3.60	-3.60	-3.60	-3.60	-3.60	-3.60	-3.60	-3.60
11	BEFORE TAX CASH FLOW		40.79	46.18	39.96	28.63	21.18	14.63	8.96	4.18	0.29
12	- ACRS Depreciation		-19.00	-30.40	-22.80	-15.20	-7.60	0.00	0.00	0.00	0.00
13	Taxable Income		21.79	15.78	14.16	13.43	13.58	14.63	8.96	4.18	0.29
14	Income Tax 46%		-10.02	-7.26	-6.50	-6.18	-6.25	-6.73	-4.12	-1.92	-0.13
15	Inv. Tax Cred. 10%		10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	AFTER TAX CASH FLOW		40.77	38.92	30.45	22.45	14.93	7.90	4.84	2.26	0.16
	Cum. After Tax Cash Flow	-100.00	-59.23	-20.31	10.14	32.59	47.52	55.42	60.25	62.51	62.67
17	Prod. Sav. at 30%		30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
18	Cont. IRR w/shared savings 20.0%										
19	Cont. IRR w/o shared savings 17.6%										
20	DOD Prog. Benefit	-10.00	-10.79	-16.18	-6.96	1.37	8.82	15.37	21.04	25.82	29.71
21	Cum. DOD Prg. Ben.	-10.00	-20.79	-36.97	-43.93	-42.56	-33.74	-18.36	2.68	28.50	58.20
22	DOD IRR 15.2%										
23	Tot. Gov. Benefit	-10.00	-10.77	-8.92	-0.45	7.55	15.07	22.10	25.16	27.74	29.84
24	Cum. Gov. Benefit	-10.00	-20.77	-29.69	-30.14	-22.59	-7.52	14.58	39.75	67.49	97.53
25	Gov. IRR 27.7%										
26	Cont. Payb. Period 2.7 yrs										
27	DOD Payb. Period 6.9 yrs										
28	Gov. Payb. Period 5.3 yrs										

APPENDIX B

MEMORANDUM OF UNDERSTANDING

Whereas, Naval Sea Systems Command is desirous of entering into an agreement with General Dynamics, Pomona Division and its subcontractor, Thiokol Coryoration, for the purpose of improving industrial technology and reducing costs of the Standard Missile MR MK-104 DTRM program under the Industrial Modernization Incentives Program (IMIP) and,

Whereas, General Dynamics, Pomona Division and its subcontractor, Thiokol Corporation, desire to participate in the IMIP,

Therefore, it is agreed that the IMIP shall be conducted within the guidelines and conditions as set forth in this Agreement.

General Dynamics, as long as it is the prime contractor for the MK 104 Dual Thrust Rocket Motor, will manage, monitor, audit and maintain overall cognizance over the incorporation of up to approximately seven million dollars ($7,000,000) of improvements to facilities by Thiokol, including new equipment and engineering management applications, to improve overall productivity through advanced technologies which will reduce the production costs of the MK-104 Dual Thrust Rocket Motor. The principal manufacturing and management systems to be covered are:

Nozzle Fabrication
Insulation, fabrication and case preparation
Cast/cure/core pop/x-ray
Final assembly
Propellant materials preparation and mixing
Igniter fabrication and ignition system assembly

Material acquisition and issue
Manufacturing/inspection planning
Scheduling
Material Review System
Cost control
Tool sustenance and periodic inspection
Product oriented mode or operation

Naval Sea System Command will provide the opportunity for Thiokol Corporation to recoup its investment and a reasonable return thereon, through shared savings based upon baseline prices to be negotiated.

Nothing in this MOU shall be construed as precluding the Naval Sea Systems Command from purchasing its MK 104 DTRM requirements, for the fiscal years 1985 and beyond, directly from Thiokol, in which event all General Dynamics IMIP responsibilities referred to in this MOU shall cease for said requirements.

The parties agree to negotiate an IMIP in accordance with NAVMAT Notice 5000, DODI-5000.XX and the following:

a. The Thiokol total investment covered under this agreement shall not exceed $7,000,000.

b. Shared savings are defined as the cost reductions that are generated from the productivity enhancing investments and engineering management applications which will reduce the cost of MK 104 DTRM.

c. If NAVSEA should complete the production of MK 104 motors during the course of the IMIP contract and Thiokol should lose the competition, the IMIP contract shall be terminated. In such an event Thiokol shall be indemnified in accordance with the termination provisions of DODI 5000.XX for the unrecovered depreciation for those severable facility items requested by Thiokol which are mutually agreed to be excess to Thiokol's known requirements.

d. In the event termination protection is provided in accordance with DODI-5000.XX the following not-to-exceed amount of government liability to Thiokol by Government FY in which the termination occurs shall govern.

GFY 83	$ 295,000
GFY 84	2,726,000
GFY 85	3,712,000
GFY 86	582,000
GFY 87	-0-

e. The estimated baseline unit prices for computation of savings for the MK 104 Dual Thrust Rocket Motor for the minimum quantity of motors delivered (including the price for lot acceptance test and verification motors), by Government fiscal year contract, shall not exceed the following:

	Unit Price	Min Deliverable Qty
GFY 83	$369,700	30
GFY 84	163,548	390
GFY 85	155,778	475
GFY 86	139,797	830

If an adjustment in deliverable quantities is made, an adjustment to the unit price will be made.

f. It is agreed, by the parties hereto, to enter into negotiations within 120 days to establish the specific terms for implementation of this agreement.

g. The Government shall not incur any liability or obligation for work performed prior to the execution of this agreement.

Upon execution of this agreement, which shall become effective upon the signature of all three parties, Thiokol shall promptly proceed to implement the IMIP program in recognition of the intent of having the improvements in place for the processing of FY83 MK-104 motors, provided that, if an IMIP agreement is not executed NAVSEA shall incur no liability to either General Dynamics or Thiokol and General Dynamics shall incur no liability to Thiokol.

APPENDIX C

SOURCES OF GROWTH OF REAL GROSS PRODUCT

U.S. domestic business economy, sources of growth of real gross product, contributions to growth in percentage points. 1948-66 and 1966-76

	1948-66	1966-76
Real gross product	3.9	2.8
Tangible factor inputs	1.0	1.4
Total factor productivity	2.9	1.4
Advances in knowledge	1.4	1.1
Formal R&D	.85	.7
Informal	.3	.3
Changes in rate of dif.	.25	.1
Changes in quality of labor	.6	.5
Education and training	.6	.8
Health and vitality	.1	.1
Age-sex composition	-.1	-.4
Actual/potential eff.	-	-
Changes in quality of land	-	-.1
Resource reallocations	.3	.1
Self-employment to emp.	.1	-
Interindustry labor shifts	.4	.1
Weighting effects	-.2	-
Volume-related factors	.6	-.2
Economies of scale	.5	.3
Intensity of demand	.1	-.5
Irregular factors	-	-
Net gov. impact	-	-.1
Gov. services to business	.1	.1
Business services to gov.	-.1	-.2
Residual factors, n.e.c.	-	.1

Source: John W. Kendrick, "Total Investment and Productivity Developments," paper prepared for a joint session of the American Economic and Finance Associations, New York, December 30, 1977 (available on request to the author), based for the 1948-66 period mainly on estimates from Edward F. Denison, Accounting for United States Economic Growth, 1948-1969 (Washington, D.C.: The Brookings Institution, 1974).

APPENDIX D

FREE MARKET--DEFENSE MARKET COMPARISON

Some Examples of "Market Imperfections and Failures" in Defense

Free-Market Theory	Defense Market
Many small buyers.	One buyer (DoD).
Many small suppliers	Very few, large suppliers of a given item.
All items small, perfectly divisible, and in large quantities.	One ship built every few years, for hundreds of millions of dollars each.
Market sets prices.	Monopoly or oligopoly priciing--or "buy in" to "available" dollars.
Free movement in and out of market.	Extensive barriers to entry and exit.
Prices set by marginal costs.	Prices proportional to total costs.
Prices set by marginal utility.	Any price paid for the desired military performance.
Prices fall with reduced demand.	Prices rise with reduced demand.
Supply adjusts to demand.	Large excess capacity.
Labor highly mobile.	Greatly diminishing labor mobility.
Decreasing or constant returns to scale.	Increasing returns to scale in region of interest.
Market shifts rapidly to changes in supply and demand.	7-10 years to develop a new system, then 305 years to produce it.
Market smoothly reaches equilib.	Erratic behavior from year to year.
General equilibrium--assumes prices will return to their equilibrium value.	Costs have been rising at approximately 5% per year (excluding inflation).
Profits equalized across the economy.	Wide and consistent profit variations between sectors; even wider between firms.
Perfect mobility of capital (money).	Heavy debt, difficulty in borrowing.
Mobility of capital (equipment) to changing demand.	Large and old capital equipment "locks in" companies.

No government involvement.	Government is regulator, specifier, banker, judge of claims, etc.
Selection based on price.	Selection often based on politics, or sole source, or "negotiation"; only 8% of dollars awarded on price competition.
No externalities.	All businesses working for DoD must satisfy requirements of OSHA, EEO, awards to areas of high unemployment, small business set-aides, etc.
Prices fixed by market.	Most business, with any risk, is for "cost plus fee."
All products of a given type are the same.	Essentially, each producer's products are different.
Competition is for share of market.	Competition is frequently for all or none of a given market.
Production is for inventory.	Production occurs after sale is made.
Size of market established by the buyers and sellers.	Size of market established by "third party" (Congress) through annual budget.
Demand sensitive to price.	Demand "threat"-sensitive, or responds to availability of new technology; almost never price-sensitive.
Equal technology throughout industry.	Competitive technologies.
Relatively stable, multiyear commitments.	Annual commitment, with frequent changes.
Benefits of the purchase go to the buyer.	A "public good."
Buyer has the choice of spending now or saving for a later purchase.	DoD must spend its annual congressional authorization.

LIST OF REFERENCES

1. Carlucci, F.C., ODSD, "Charter Test of the Industrial Modernization Incentives Program," 2 November 1982.

2. "DOD Industrial Modernization Incentives Program Instruction" (Proposed Draft) 5000.XX, ODSD, 2 November 1982.

3. "DOD Guide for Improving Productivity in Defense Contracting," (Draft), OSD, 1982.

4. Stimson, R.A. and A.D. Reeves, "Improving Defense Contractor Productivity," Defense Management Journal, Third Quarter 1983.

5. Memorandum Status Report on the Industrial Modernization Incentives Program (IMIP), ODSD, 17 June 1983.

6. Memorandum Guide on the Acquisition Improvement Program (AIP), Second Year Report, ODSD, 8 June 1983.

7. "Implementation of the Industrial Modernization Incentives Program Test," Department of the Air Force, 25 August 1983.

8. Memorandum on Industrial Modernization Incentives Funding, OSD, 17 June 1983.

9. Reeves, A.D., OUSD, "The Industrial Modernization Incentives Program: An Experimental Effort To Improve Defense Contractor Productivity," Presented at 1983 Federal Acquisition Research Symposium, 26 August 1983.

10. Cost Accounting Standards and Regulations, U.S. Government Printing Office, December 1980.

11. "Industrial Modernization Incentives Program Memorandum of Agreement On The Standard Missile MR MK-104 DTRM Contract Between General Dynamics, Pomona Division, And Its Subcontractor Thiokol Corporation And The Department of the Navy, Naval Sea Systems Command," Naval Sea Systems Command, 8 September 1983.

12. "Industrial Modernization Incentives Program Memorandum of Understanding on Basic Ordering Agreement N00019-83-0049 Between Grumman Aerospace Corporation and the Department of the Navy, Naval Air Systems Command," Naval Air Systems Command, (Proposed 1983).

13. U.S. Congress. Subcommittee on Priorities and Economy in Government of the Joint Economic Committee. Hearings, Improving National Productivity, 92nd Congress, 2nd session, 1972. Washington, D.C.: Government Printing Office, 1972.

14. Kendrick, J.W. and E.S. Grossman, Productivity in the United States, 1st edition, Johns Hopkins University Press, 1980.

15. The Rand Corporation Report Memorandum RM-5610-PR, Defense Profit Policy in the United States and the United Kindgom, by I.N. Fisher and G.R. Hall, October 1968.

16. "Capital Spending Plans for 1971 Pared Sharply," The Wall Street Journal, volume CLXXVII number 106, p. 3, Wednesday, 2 June 1971.

17. National Commission on Productivity, Second Annual Report, March 1973. Washington, D.C.: Government Printing Office, 1973.

18. U.S. Congress. Congressional Budget Office, The Productivity Problem: Alternatives for Action, January 1981. Washington, D.C.: Government Printing Office, 1981.

19. U.S. Congress. Committee on Armed Services, Senate. Hearings, Nomination of Caspar W. Weinberger to be Secretary of Defense, 97th Congress, 2nd session, 1981. Washington, D.C.: Government Printing Office, 1981.

20. "Solution Sought for Production Lag," Aviation Week, Volume 112, Number 22, 2 June 1980.

21. U.S. General Accounting Office, Impediments to Reducing the Costs of Weapon Systems, 3 November 1979. Washington, D.C.: Government Printing Office, 1980.

22. U.S. Congress. The Committee on Armed Services and the Panel on Defense Industrial Base of the Committee on Armed Services, House of Representatives. Capability of the Defense Industrial Base, 96th Congress, 2nd session, 1980. Washington, D.C.: Government Printing Office, 1980.

23. Fox, Ronald J., Arming America, Harvard University, 1974.

24. U.S. Congress. Subcommittee on Federal Procurement and Regulation of the Joint Economic Committee. Hearings, Economic Impact of Federal Procurement, 89th Congress, 2nd session, 1966. Washington, D.C.: Government Printing Office, 1966.

25. Office of the Secretary of Defense, Defense Acquisition Regulations, Washington, D.C.: Government Printing Office, 1983.

26. U.S. Congress. Subcommittee on Priorities and Economy in Government of the Joint Economic Committee. Hearings, The Acquisition of Weapon Systems, 92nd Congress, 1st session, 1972. Washington, D.C.: Government Printing Office, 1972.

27. Deputy Secretary of Defense Memo of 5 August 1970 to the Secretaries of the Military Departments entitled "Cost Growth."

28. Report of the Acquisition Cycle Task Force, Defense Science Board Summer Study, 15 March 1978, Washington, D.C.: Government Printing Office, 1978.

29. Weinberger, Caspar W., "Where We Must Build--and Where We Must Cut," Defense/81, Washington, D.C.: Government Printing Office, December 1981.

30. "The Acquisition Process: A Brief Historical Perspective," Concepts, Volume 5, Number 3, Summer 1982, Defense Systems Management College.

31. Bertrand, Harold E., The Defense Industrial Base: Executive Summary. Logistics Management Institute, 1977.

32. Koistinen, Paul A.C., The Military Industrial Complex, Praeger, 1980.

33. Logistics Management Institute Report AD660-388, Weighted Guidelines Changes and Other Proposals for Incentives for Contractor Acquisition of Facilities, September 1967.

34. Paulson, Jr., H.M., Staff Assistant to the Office of the Secretary of Defense (Comptroller), DOD Profit on Capital Policy, paper presented to National Contracting Management Association (NCMA), Chapters in March 1972.

35. U.S. Government. Cost Accounting Standards Board. Cost Accounting Standard 409, Washington, D.C.: Government Printing Office, 1975.

36. U.S. Congress. Joint Committee on Defense Production, DIB: DOD Procurement Practices, Washington, D.C.: Government Printing Office, 1977.

37. U.S. General Accounting Office, Recent Changes in the Defense Department Profit Policy: Intended Results Not Achieved, Washington, D.C.: Government Printing Office, 1978.

38. Department of Defense. Annual Report to the Congress: FY 1983, Washington, D.C.: Government Printing Office, 1983.

39. Gansler, J.S., The Defense Industry, MIT, 1980.

40. U.S. General Accounting Office, Progress of Federal Procurement Reform Under Executive Order 12352, Washington, D.C.: Government Printing Office, 1983.

41. "Commodore Platt is Navy's First Competitive Acquisition Advocate General," The Navy Supply Corps Newsletter, Volume 46, Number 6, September/October 1983.

42. Young, R.S., White, R.P., and O'Hern, T.M., Procurement Workload versus Workforce--A Growing Imbalance, Logistics Management Institute, May 1981.

43. Wallich, Henry C., Is There a Capital Shortage?, remarks to the International Monetary Conference as a member, Board of Governors of the Federal Reserve System, Session II: Capital Requirements and Capital Sources in Amsterdam, The Netherlands, Wednesday, 11 June 1975.

44. Lipsey, Richard C. and Peter O. Steiner, Economics, 5th edition, Harper and Row, 1978.

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